A VALIDATION STUDY OF AN EDUCATIONAL COGNITIVE STYLE INTEREST INVENTORY (FORM J-O) FOR JUNIOR HIGH SCHOOL STUDENTS

BY

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The purpose of this study was to determine the reliability and validity of the Educational Cognitive Style Interest Inventory (ECSII) for junior high school students developed by Lee J. Mullally, which was based on the theoretical framework of Hill.

The sample consisted of 811 sixth through ninth grade students from central and north central Florida. A self-report questionnaire comprised of 27 subscales with eight items per subscale was administered. Responses were recorded as "usually," "sometimes," and "rarely," with numerical values of 5, 3, and 1, respectively.

Means and standard deviations of the total sample were determined. Cronbach´s alpha reliability coefficients were calculated to assess the internal consistency of the intrument, and ranged from .2579 to .7059. Program PEARSON CORR was used to determine the relationship between the 27 subscales, and a significant correlation was detected among all of the subscales. Program FACTOR/PRIN was used for further factor analysis, and three factors were retained. From the emerged factor structure of the ECSII, 56% was congruent with the structure proposed by Hill. Group differences were detected by using a 3x2 (grade level, sex) factorial design, and significant main effects were found for both variables. School location was included as an independent variable, and significant main effects were detected. For some subscales, significant interactions were found between grade level and sex, and between school location and sex.

The ECSII was determined to be reliable if used with groups, but the internal consistency of the instrument is questionable for individual diagnosis. Some improvements and refinements were suggested. Recommendations for further studies are (a) an analysis of the homogeneity of the items, and (b) a validation of the "new" structure of the ECSII suggested by this study.

CHAPTER 1
INTRODUCTION

Many practitioners in the classroom have been using instruments for measuring learning styles without questioning the reliability and validity of the construct "cognitive style." Moreover, a review of the literature reveals that each author of an instrument has a unique conceptualization of the construct of that instrument. Thus, theoretical development regarding the cognitive style paradigm has been divergent, not convergent. Chapter 1 includes the background of the study regarding cognitive style in general and refers to Mullally's Educational Cognitive Style Interest Inventory, which is based on the conceptual framework of Hill (1981).

Background of the Study

The term "cognitive style" has been used in psychological literature since the turn of the century (Allport, 1937). However, during only the last 25 years has significant research been conducted in an effort to discover differences among methods or styles of processing

information (Coop & Sigel, 1971). Cognitive style is considered a psychological construct that abstractly represents a domain of observable behaviors and deals with the question of how one learns and processes information. How one learns is style, and cognition is a mediating process that has been the center of a resurgence of interest in cognitive style. In general, research on cognitive style emphasizes how people respond to their environment (Goldstein & Blackman, 1978). Since one of the aims of education is to prepare students to deal effectively with their environments, the topic of cognitive style and its implications for education is worthy of investigation.

A review of the literature reveals that there is disagreement among researchers concerning the definition of style or cognitive style (e.g., Allport, 1937; Bruner, Goodnow, & Austin, 1956; Guilford, 1959; Kagan, Moss & Sigel, 1963; Messick, 1976; Witkin, Dyk, Faterson, Goodenough, & Kays, 1962). Allport (1937) uses the word "style" to describe consistencies and patterns demonstrated by individuals in their day-to-day activities. Bruner et al. (1956) refer to style as the adoption of a particular cognitive strategy in order to arrive at a correct answer. Witkin et al. (1962) refer to style as a particular ability that is highly perceptual in nature. They define a field-independent (or analytical) person as one who tends to give more credit to internal references, whereas a field-dependent (or global) person is more likely

to rely upon external referents as guides in information processing. On the other hand, Kagan et al. (1963) describe three basic cognitive styles--descriptive, relational, and categorical--based on childrens´ and adults´ performance on grouping and sorting tasks. These authors consider subjects´ preferences and do not test particular cognitive abilities or strategies per se. Other writers have referred to cognitive style as Guilford´s (1959) convergent, divergent, and evaluative types of cognitive operations.

In an effort to organize and integrate these divergent views of cognitive style, Messick (1970) conceived the concept as representing consistencies in the way people organize and process information, such as ways in which they perceive, remember, think, and solve problems. He conceptualized cognitive style in terms of nine categories

1. Field independence vs. field dependence--an analytical vs. global way of perceiving.

2. Scanning--differences in the extensiveness and intensity of attention deployment.

3. Breadth of categorizing--consistent preferences for broad inclusiveness as opposed to narrow exclusiveness in establishing the acceptable range for specified categories.

4. Conceptualizing style--tendency to conceive of things as having many properties as opposed to few.

5. Cognitive complexity vs. simplicity--individual differences in the tendency to view the world in a multidimensional and discriminant way.

6. Reflectiveness vs. impulsivity--individual consistencies in the speed with which hypotheses are selected and information processed.

7. Leveling vs. sharpening--reliable individual variations in assimilation in memory.

8. Constricted vs. flexible control--individual differences in susceptibility to distraction and cognitive interference in tasks containing conflicting cues.

9. Tolerance for unrealistic experiences--a dimension of differential willingness to accept perceptions at variance with conventional experience.

In 1976, Messick modified these nine categories, added new ones, and listed a total of 19 approaches to the study of cognitive style.

In brief, the topic of individual differences in cognitive style has attracted a great deal of attention and generated a wide variety of approaches to define stylistic differences among learners. Moreover, the lack of commonality in the definition of "cognitive style" has caused this term to become "investigator specific." The concepts of cognitive style cited suggest considerable variation in the processing of information by different individuals and are limited in usefulness by their lack of prescriptive features to meet individual needs for learning.

In 1964, the late Joseph Hill, from Oakland Community College in Bloomfield Hills, Michigan, attempted to eliminate or reduce the cited weaknesses regarding cognitive

style assessment. Instead of viewing cognitive style from a psychological construct applied to education, Hill chose to define "educational cognitive style" as the means whereby an individual seeks meaning from a personal interaction with his environment (Hill, 1981).

The theoretical construct of educational cognitive style is a Cartesian product of four sets of behaviors which comprise an individual´s educational cognitive style map (ECSM): (a) symbols and their meanings (abilities expressed from among 19 possibilities); (b) cultural determinants of the meaning of symbols (influences by family or authority, associates, and/or individuality); (c) modalities of inference (expressed as processes to derive meaning); and (d) neurological, electrochemical, and biochemical aspects of memory functions. The latter set has not been sufficiently developed to permit its use in most educational settings at this time (Hill, 1981).

Hill, unlike some psychological researchers, believes that the Educational Cognitive Style (ECS) of an individual can be changed by the process of education, and that his model can be pragmatically applied to educational situations as expressed in his book, <u>The Educational Sciences: An Introduction</u> (1981):

> The construct of cognitive styles which has been developed as one of the seven educational sciences is different in purpose and design from those defined and described in the discipline of psychology. In purpose, educational cognitive style is an applied body of information designed to deal with practical considerations associated with contexts

> involving both informal and formal educational endeavors. It is not the purpose of educational cognitive style to describe and explain psychological behaviors of the individual throughout his or her life-space. It is a means, however, for improving the logical consistency and precision of analyses, validations, and syntheses of informal and formal educational endeavors and contexts. (pp. 65-66)

Hill's theoretical framework has been the base for many projects, programs, and doctoral dissertations conducted in different areas (science, math, arts, language, social studies, business, nursing, counseling) and in different educational settings (Nunney, 1978).

However, very little attention has been given to validation at different educational levels. The degree of confidence that the user can place in interpreting results is directly related to both reliability and validity of the instrument used. As Kerlinger (1973) states: "If one does not know the reliability and validity of one's data little faith can be put in the results obtained and the conclusions drawn from the results" (p. 442).

The present study was based upon Hill's conceptual framework of Educational Cognitive Style and was specifically concerned with the validation of Mullally's modified version of the Educational Cognitive Style Interest Inventory for junior high school students (Form J-O).

Statement of the Problem

The present study was concerned with assessing the reliability and validity of the modified version of the Educational Cognitive Style Interest Inventory (Form J-O) developed by Mullally in 1980 and designed for junior high school students.

Purposes of the Study

The purposes of the present study were

1. to determine whether the Educational Cognitive Style Interest Inventory (Form J-O) is reliable and valid.

2. to investigate the interrelationships among the ECS´ subscales.

3. to determine whether individual differences in educational cognitive styles are related to students´ sex, grade level, and school location.

The questions to be answered are as follows:

1. Are the ECS´s subscales internally consistent?

2. What is the factor structure of the ECS Interest Inventory Form J-O?

3. To what extent are the subscales concerning symbols and their meanings correlated to Hill´s Scale I?

4. To what extent are the subscales concerning cultural determinants correlated to Hill's Scale II?

5. To what extent are the subscales concerning modalities of inference correlated to Hill's Scale III?

6. What are the relationships among educational cognitive style subscales and students' sex, grade level, and school location?

Significance of the Study

Joseph Hill developed his model of educational cognitive style not only for theory development but also for applied purposes. Moreover, Hill believed that educational cognitive style was free to be modified and changed by the process of training and education. Hill's educational cognitive style interest inventory has been widely used and appears to be a useful instrument for measuring students' self-perceptions about their manner of seeking meaning.

Theoretically, the significance of this study lies in the nature of the factors emerging from the factor analytic study of the Educational Cognitive Style Interest Inventory Form J-O (ECSII). The results of the empirical investigation of the instrument, hopefully, will lead other researchers to continue working on further validation studies of ECSII.

Educationally, the significance of this study lies in the potential usefulness of the instrument to measure

adolescents' educational cognitive styles. Teachers would be able to make tentative judgments about the learning needs of their students and about prescribing instructional materials and strategies that best match their particular styles. Based upon this information, teachers could build a personalized program of instruction including individual differences such as gender, age, and geographical location of schools.

The different interest inventory forms used to determine educational cognitive styles need to demonstrate reliability and validity before being used. As a preliminary study of validation of this instrument, this researcher believes that the initial findings obtained by exploring the nature and the relationships of the subscales of the ECSII (Form J-O) will contribute to the generation of new hypotheses for further research.

Definition of Terms

Definitions of terms are included for a better understanding of the analysis of results and conclusions of this study.

Educational Cognitive Style (ECS) consists of ways in which an individual perceives, reacts, and tends to seek meaning from his personal interaction with his/her environment.

<u>An Educational Cognitive Style Map</u> (ECSM) is a graphic representation of an individual´s strengths and weaknesses with each of the 27 elements that are assessed by the Educational Cognitive Style Interest Inventory (Appendix A). An ESCM is printed in the form of a Cartesian Product of three sets or scales.

A <u>Cartesian Product</u> is a particular type of space or set of all ordered pairs of two given sets such that the first elements of the pairs are chosen from one set and the second elements from the other set. In a general sense, the "product" may be described as the set of all ordered combinations of $\underline{n}$ elements of $\underline{n}$ given sets, such that the first through the $\underline{n}$ th elements of the combinations are selected in the fashion previously described (Hill, 1981). In Hill´s Cartesian product, g = SxExH (Figure 1), the "x" sign does not indicate multiplication but represents the grouping of those elements in the space or set to generate the Cartesian product (Harman, 1976).

The <u>Educational Cognitive Style Interest Inventory</u> (ECSII) is an instrument used to measure 27 elements of a student´s ECS. The ECSII consists of a questionnaire of 216 items representing 27 elements or subscales with eight items for each subscale (Appendix B). According to Hill (1981) there are three sets or scales comprising the Interest inventory: (a) scale I, symbols and their meanings; (b) scale II, cultural determinants; and (c) scale III,

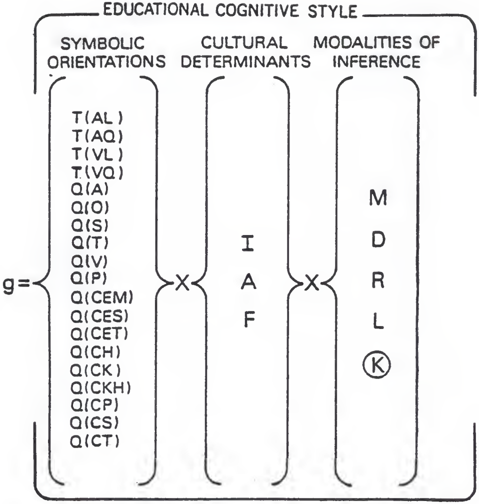


Figure 1. Hill's Cartesian Product of the Educational Cognitive Style (Modified from Hill, 1981).

modalities of inference, consisting of 19, 3, and 5, subscales, respectively.

A brief guide to the ECSM based on the three scales and their corresponding subscales is provided as follows (Hill & Nunney, 1972).

Scale I. Symbols and their meanings. Two types of symbols, theoretical (e.g., words and numbers) and qualitative (e.g., sensory, programmatic, and cultural codes) are created and used by individuals to acquire knowledge and derive meaning from their environments and personal experiences. Theoretical symbols differ from qualitative symbols in that the theoretical symbols present something different from that which the symbols are. The two main types of theoretical symbols are auditory and visual, and are categorized as linguistic (words) and quantitative (numbers).

T(VL)--Theoretical Visual Linguistics--preference to find meaning from reading words.

T(AL)--Theoretical Auditory Linguistics--preference to acquire meaning through hearing spoken words.

T(VQ)--Theoretical Visual Quantitative--preference to acquire meaning in terms of numerical symbols, and measurements that are written.

T(AQ)--Theoretical Auditory Quantitative--preference to find meaning in terms of numerical symbols, and measurement that are spoken.

The five qualitative symbols associated with sensory stimuli are as follows:

Q(A)--Qualitative Auditory--preference to perceive meaning through the sense of hearing, by distinguishing among sounds, tones and music, and other purely sonic sensations.

Q(O)--Qualitative Olfactory--preference to perceive meaning through the sense of smell.

Q(S)--Qualitative Savory--preference to perceive meaning by the sense of taste.

Q(T)--Qualitative Tactile--preference to perceive meaning by the sense of touch, temperature, and pain.

Q(V)--Qualitative Visual--preference to perceive meaning through sight.

The qualitative symbols that are programmatic in nature are as follows:

Q(P)--Qualitative Proprioceptive-- preference to combine or coordinate several senses into a specific function or operation (e.g., playing the piano from sheet music, catching a baseball, typing from written material, being left-handed or right-handed).

The remaining 10 qualitative symbols associated with cultural codes are defined as follows:

Q(CEM)--Qualitative Code Empathic--sensitivity to the feelings of others; ability to put yourself in

another person´s place and see things from his point of view.

Q(CES)--Qualitative Code Esthetic--preference to enjoy the beauty or order of an object or an idea. Beauty in surroundings or a well-turned phrase is appreciated by a person possessing a major strength in this area.

Q(CET)--Qualitative Code Ethic--commitment to a set of values, a group of principles, obligations and/or duties. This commitment need not imply morality. Both a priest and criminal may be committed to set of values although the "values" may be decidely different.

Q(CH)--Qualitative Code Histrionic--preference to exhibit a deliberate behavior, or play a role to produce some particular effect on other persons. This type of person knows how to fulfill role expectations.

Q(CK)--Qualitative Code Kinesics--preference to understand, and to communicate by, non-linguistic functions such as facial expressions and motions of the body (e.g., smiles and gestures).

Q(CKH)--Qualitative Code Kinesthetic--preference to perform motor skills, or effect muscular coordination according to a recommended, or acceptable form (e.g., bowling or golfing according to form).

Q(CP)--Qualitative Code Proxemics--interpreting the physical and social distance that the other person would permit between oneself and that other person.

Q(CS)--Qualitative Code Synnoetics--personal knowledge of oneself.

Q(CT)--Qualitative Code Transactional--preference to maintain a positive communicative interaction which significantly influences the goals of the persons involved in that interaction (e.g., salesmanship).

Scale II. Cultural determinants. The cultural determinants of the meaning of symbols are described by Individuality (I), Associates (A), and Family or authority figure (F). It is through these "determinants" that cultural influences are brought to bear by the individual on the meaning of symbols.

I--Individuality--denotes a preference to use one's own interpretations as an influence on the meaning of symbols.

A--Associates--meanings are influenced by one's peer group.

F--Family or authority figure--denotes influence of members of the family on the meaning of symbols.

Scale III. Modalities of inference. The third set of the Cartesian product indicating educational cognitive style includes elements relating to the individual's

modality of inference, e.g., the patterns of reasoning one tends to use.

M--Magnitude--this is a form of "categorical reasoning" that utilizes norms or categorical classifications as the basis for accepting or rejecting an advanced hypothesis. Persons who need to define things in order to understand them reflect this modality.

D--Difference--this pattern suggests a tendency to reason in terms of one-to-one contrasts of selected characteristics or measurements.

R--Relationship--this refers to the ability to synthesize a number of dimensions or incidents into a unified meaning, or through analysis of a situation to discover its component parts.

L--Appraisal--this refers to the modality of inference employed by an individual who uses all three modalities noted above (M, D, R), giving equal weight to each in his reasoning process. Individuals who employ this modality tend to analyze, question, or, in effect, appraise that which is under consideration in the process of drawing a conclusion.

K--Deductive--this is the form of logical proof used in mathematics or that employed in syllogistic reasoning.

Assumptions of the Study

The present study assumed that

1. All the students comprehended the interest inventory items.

2. Students´ opinions were considered "held opinions," and they were participating in the study on their own volition.

3. The conditions under which the instrument was administered were standardized across classrooms to avoid variances in the moods or attitudes of students when answering the questionnaire.

4. All inventory elements or subscales were normally distributed throughout the sample.

Delimitations of the Study

The study was delimited to the modified version of Educational Cognitive Style Interest Inventory (Form J-O) developed by Lee J. Mullally for junior high school students, and to the robustness of the factor analytic statistic in extracting common variance among the 27 subscales.

Limitation of the Study

The methodology for determining validity of the instrument was limited to the use of a paper-and-pencil

instrument. Complementary procedures of validation, such as judge rating scales, observations of students´ overt behavior by the teacher, and the use of other students´ characteristics profiles, would improve the accuracy of measurement of the validity of the interest inventory.

Overview of Chapters

A review of related literature is presented in Chapter 2 and is divided into three sections considering an overview of the conceptual background of Educational Cognitive Style, the historical evolution of the Educational Cognitive Style, and studies within Educational Cognitive Style that relate to the elements within this study.

The design of the study, selection of the subjects, instrumentation, methodology of data collection, statistical procedures, and statement of the hypotheses are included in Chapter 3. Data analysis, results, and discussion are presented in Chapter 4, and conclusions and implications for further study are included in Chapter 5.

CHAPTER 2
REVIEW OF RELATED LITERATURE

This chapter will explore the literature related to Educational Cognitive Style, and will present the material in three major sections. The first section includes an overview of the conceptual background of Educational Cognitive Style. The second section includes the historical evolution of Educational Cognitive Style. The third section reviews the development of interest inventories based upon Educational Cognitive Style theory. The fourth section examines those studies within Educational Cognitive Style that relate to the variables within this study.

Overview of the Conceptual Background of Educational Cognitive Style

The conceptual framework for Educational Cognitive Style (ECS) is based on Hill´s concept of education and the educational sciences (1981) which consider the following assumptions:

1. Education is the process of searching for meaning.
2. Thought is different from language.

3. Man is a social creature with a unique capacity for deriving meaning from his environment through the creation and use of symbols.

4. Not content with biological satisfactions alone, man continually seeks meaning.

The framework is composed of those applied sciences considered to be fundamental to education, where education is defined as the process of searching for meaning within a social system comprised of persons, processes, and properties, and their interconnections over a defined period of time. An analysis of this system shows that there are seven essential sciences that form the framework of the educational sciences. Each of these sciences can be defined in terms of concepts, factual descriptions, generalizations, and characteristics.

The seven educational sciences are (a) symbols and their meanings; (b) cultural influences on the meanings of symbols; (c) modalities of inference; (d) memory expressed in terms of functions, concerns, and conditions, and how these "terms" might be reflected in biochemical functions and neurophysiological measurements; (e) educationally defined cognitive styles of individuals; (f) counseling, administrative; teaching and student styles; and (g) systemic analysis of decision-making (Hill, 1981).

According to Hill´s Educational Cognitive Style is the fifth educational science, which includes the four first

sciences (symbols and their meaning, cultural determinants, modalities of inference, and memory functions). However, the latter set has not been sufficiently developed to allow its use in instructional settings at the present time. Thus ECS, in the present study, will refer only to the first three sciences (Figure 2).

Historical Evolution of the Educational Cognitive Style

As mentioned in Chapter 1, many psychologists have been interested in the study of individual cognitive styles since the beginning of this century (e.g., Gardner, 1953; Kagan et al., 1963; Messick, 1976; Witkin et al., 1962). However, Hill´s (1981) definition of educational cognitive style as an educational science is "somewhat different from those described and defined in the discipline of psychology" (p. 462). According to Hill, the "educational cognitive style" is a construct that should be considered multidimensional. Hill believes that educational cognitive style was not fixed, as in Messick´s model, but is free to be modified and changed by the process of training and education as one moves through various levels of educational development. "It should be noted," he states, "that in actual practice the maximum number of elements that can be included in an individual´s style, at a given level of educational development, is 3,200" (p. 467).

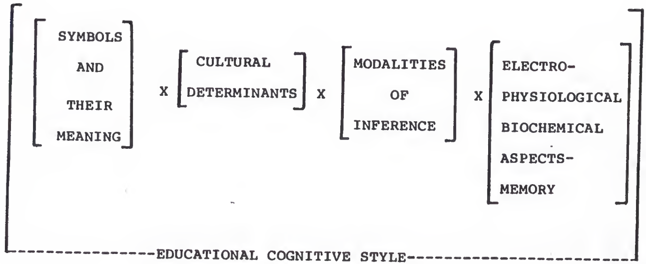


Figure 2. Cartesian Product of Sets of Educational Cognitive Style (modified from Hill, 1981).

Symbols and Their Meanings

The assumption of the first educational science, symbols and their meanings, is that man uses two kinds of symbols--theoretical and qualitative. Hill's primary sources of the conceptualizations associated with this science were derived from the works of Dewey (1938), Korzybski (1958), Langer (1942), and Wittgenstein (1953). Further influences emerge from the works of Bloom (1974), Bruner (1966), Hayakawa (1964), Kimura (1973), Phenix (1964), and Piaget (1952).

Symbols are used to create, perceive, and perform educational tasks existing in one's environment. According to Hill (1981), "various meanings are created by individuals to deal with the multitude of contextualisms that comprise their respective life-spaces" (p. 404). For instance, learning a language or mathematics requires the use of theoretical symbols, or thought-related elements which are expressed by words and numbers. The spoken word "cat" is a symbol that represents the real animal, cat. In ECS, the spoken word "cat" is represented by the theoretical auditory linguistic symbol or T(AL). The written word "cat" is a theoretical visual linguistic symbol T(VL) and is used to represent a real cat. Theoretical quantitative symbols are also expressed by both T(AQ), e.g., spoken number "3," and T(VQ), e.g., written number "3."

Qualitative symbols present and then represent the symbol itself. For example, a newborn child´s environment provides him with a set of qualitative symbols by which he senses his world (olfactory, auditory, tactile, visual images, taste). Other qualitative symbols are associated with cultural codes (or rules) which the individual develops and maintains throughout life (e.g., observing nonverbal expressions, role playing, social distance, or time constraints). According to Hill (1981), "It is through the use of these symbolic code systems that the individual interacts with his environment and brings meaning to his social and physical world for himself and others" (p. 409).

Cultural Determinants of the Meaning of Symbols

The development of cultural determinants of the meaning of symbols draws on research by Kelley (1947), Merton (1968), Sherif (1964), and others. Hill (1981) points out that "if man derives meaning from symbols not as a totally unique person, but as an individual cast in a social role, a role which has expectations imposed upon it by societal norms and groups which exert the main influence on him determine, in great part, his perceptions of life" (p. 439).

As defined in Chapter 1, cultural determinants refer to those behaviors that an individual employs when arriving at a decision or conclusion. For instance, if a person makes a decision based upon his own interpretation, he is employing individuality behavior which is indicated by (I) in the

cultural determinant set. If he relies upon parents, teachers, or authority figures in arriving at decisions, he is employing family behaviors, which is represented by (F) in the cultural determinant set. A person being influenced by peers or classmates is demonstrating associate behavior, and is represented by (A) in the ECSM.

Modalities of Inference

Concepts derived from statistics and logic, plus research by Bruner (1966), Guilford (1967), Piaget (1952), and Wertheimer (1959), form the foundation of Hill's third science. Inference is defined as a process for deriving a conclusion, and at the same time, is the conclusion, which can be classified as either an inductive or a deductive process (Hill, 1981, p. 441). An inductive process yields a probability conclusion and is the most frequently used by man. A deductive process produces a conclusion which is a consequence resulting from a particular chain of reasoning (from general to specific).

The four inductive inference processes are classified as magnitude, difference, relationship, and appraisal (Hill, 1981). Persons who need to define things in order to understand them reflect the magnitude (M) form of inference. The modality of relationship (R) is demonstrated by persons with the ability to synthesize a number of dimensions into a unified meaning. When a person tends to analyze, question or appraise a situation in order to draw a conclusion,

the person uses the modality of inference named appraisal (L), which includes the modalities noted above (M, D, and R).

Individuals also employ certain deductive inference processes, K , when dealing with information from the natural sciences, the life sciences, and mathematics. However, these processes are used relatively infrequently in daily living.

Memory

Hill´s fourth science emphasizes the neurological bases of memory and the influence of biochemical factors and electrophysiological measurements. At the time of his death in 1978, Hill´s instrument for collecting information relative to the educational memory set was still in the generative stage.

The introduction of "educational cognitive style" by Hill, when he became president of the Oakland Community College (OCC) in 1968, demonstrates that a variety of learning approaches is more desirable than a single approach (Manilla, 1971). Changes in management of the institution as well as modifications in the instructional approach occurred under Hill´s direction. By 1972, OCC had mapped the educational cognitive styles of 17,000 students and had developed distinctive prescription centers in which educational cognitive styles and mode of presentation style could be matched (Hill & Nunney, 1972).

Since then more than 100 doctoral dissertations have been completed based on Hill's educational sciences. The following sections will examine the development of interest inventories, and educational cognitive style studies which relate to the elements within the present study.

Interest Inventory Construction

Interest inventories have progressed from the initial attempts of G. Stanley Hall, who developed a questionnaire to measure children's recreational interests in 1907. Since then the emphasis of researchers such as Strong and Kuder has been on the development of interest inventories measuring vocational interests and career development (Mehrens & Lehmann, 1980).

At least two dozen standardized types of inventories are commercially published. Examples of widely used inventories are the Strong Vocational Interest Blank (SVIB); the Strong-Campbell Interest Inventory (SCII)--the latest edition of SVIB; the Kuder Occupational Interest Survey (KOIS); the California Psychological Inventory (CPI); and the Minnesota Multiphasic Personality Inventory (MMPI).

Most interest inventories share the common purpose of assessing an individual's preferences for various activities. However, there are some marked differences between interest inventories regarding their method of construction, scoring, ease of administration, ease of

interpretation, and applicable grade level. For example, there are three procedures which are commonly used to construct interest inventories--empirical, homogenous, and logical.

In the empirical method, the set of test items is constructed by item analysis. This requires the tabulation of answers actually given to questions by a group specifically selected to represent the traits one wishes to measure. Responses showing statistically significant differences between this group and the general population constitute the scoring key for this trait or characteristic (Tyler & Walsh, 1979).

Items used in the Strong-Campbell Interest Inventory, the Kuder Occupational Interest Survey, the Minnesota Multiphasic Personality Inventory, and Educational Cognitive Style Interest Inventories were empirically selected and keyed.

The test constructor employing the homogeneous method begins with a large number of items processed through factor analysis. With this procedure, one first asks a large group of subjects (representative of the population for which the test was designed) to respond to the items. The next step is to produce a table of intercorrelations among items which will produce factors that can be labeled or named according to the pattern of factor loadings (Mehrens & Lehmann, 1980).

In the third procedure, the logical method, the test constructor specifies the traits or skills of knowledge

needed for the task and then prepares items. He or she then scores the items according to his or her criteria based upon underlying psychological theory (Mehrens & Lehmann, 1984).

Educational Cognitive Style Interest Inventory Construction

The Oakland Cognitive Style Map Interest Inventory, a paper-and-pencil self-report instrument, was originally developed by Svagr, Zussman, and Fragale, doctoral students of Hill (1981), in order to map the cognitive styles of the administrative staff at Oakland Community College. The first form of this inventory was a package of cards related to the first three sets of the educational sciences. Through the Q-sort process, the educational cognitive style of each of the individuals was established.

The authors of this inventory then developed a questionnaire composed of 216 situational statements which students can identify as "usually," "sometimes," and "rarely" according to their own decisions. Each of the 27 elements has eight situational sentences, and the scoring of these sentences results in the categorization of the students as possessing "strengths" and "weaknesses" referring to any particular element in their educational cognitive style.

The Educational Cognitive Style Interest Inventory (Form J-O) used in this study was constructed by the

empirical method (L. J. Mullally, personal communication, January 5, 1984). This interest inventory is actually a modification of the original OCC Interest Inventory that was rewritten to eliminate regional bias and to accommodate a junior high school reading level.

Educational Cognitive Style Studies Related to Junior High School Students

Research has been done concerning Educational Cognitive Style at all levels of education, formal and informal, but most of this work has been done with college students (Nunney, 1978). This researcher was able to find only five studies using junior high school students as subjects (Compton, 1975; Culley, 1978; Granger, 1979; Lipson, 1975; Rundio, 1974).

Lipson (1975) examined the influence of educational cognitive style and teaching style on grading practices at Wilkenson Junior High School in Madison Heights, Michigan. The sample of this study consisted of 17 students and 1 teacher, and it was an exploratory study. Degrees of match between the cognitive style and teaching style of the teacher, and the cognitive style and preferred teaching style of students were determined. Results of this study indicate that receiving a favorable or unfavorable grade was not influenced by the student's having a major degree of match on cognitive style with the teacher and teaching-preferred teaching style.

Another study (Rundio, 1974) explored the possibility of employing ECS as a vehicle for providing information to personalize the instruction of 30 ninth graders in biology. Educational cognitive style maps were determined using Oakland Community College instruments. Collective cognitive style profiles were ascertained for each letter grade category (A through E). The findings of this study indicated that it was possible to map educational cognitive style profiles of individual students, and that collective cognitive style profiles could be ascertained for students in certain teacher-determined letter grade categories. Clues for personalizing instruction also became apparent.

Only three studies examining the relationship between ECS and achievement were found in the literature. The first study (Granger, 1979) dealt with ECS and achievement of 77 eighth graders in a discovery-approach science curriculum (Intermediate Science Curriculum Study). High achievement and low achievement groups were identified. The OCC interest inventory for junior high students was used to generate ECS maps for the 77 students. The outcome of this study supports that achievement in the discovery learning is related to cognitive style. Particularly, Granger found that the high achievement group in the discovery approach employed in this study possessed significantly stronger orientations toward the ECS´s elements M, R, and K, which represented the ways in which learners reason to draw inferences.

In the second study (Compton, 1975), 255 eighth graders enrolled at Fort Clarke Middle School in Alachua County, Florida, participated in an experiment comparing achievement of students with and without a multimedia cognitive style mapping approach to instruction (MCSMAI). This approach was represented by a multimedia approach to instruction by a team of teachers (mathematics, science, social studies, language arts, and media specialists) who used the educational cognitive style mapping developed by Bass in 1974. The design for this experiment was a pretest-posttest experimental control design analyzed by a three-way analysis of variance. The results showed that using MCSMAI appeared to be the better approach for above-average learners but was not significant for average learners. The traditional approach appeared to be the better approach for below-average learners.

In contrast, Culley (1978) found no significance when comparing achievement of 130 sixth graders and their respective ECSs. The instrument used to assess educational cognitive style was the 1975 edition of the ECSII for junior high school students by Kingsley and DeNike. Culley reported that students of high aptitude do not adopt an ECS different from that adopted by students of average aptitude. From this study, he also found that auditory and visual perception scales of the Macmillan Reading Readiness Test did not correlate significantly with scores on the ECS maps

for auditory and visual preferences in learning language. In this case, the reading readiness test was taken at the end of kindergarten and the ECSII was completed in the sixth grade. It was suggested that those results supported the position that ECSs are flexible and changing, rather than stable and fixed.

Educational Cognitive Style Studies related to Sex

Little attention has been given to sex differences when using ECS Interest Inventories. In the literature review, only one study was found regarding sex as an independent variable. Robbins (1977) compared cognitive styles across educational levels, race, and sex. A total of 696 students at freshman, senior, and graduate college level were given the Cognitive Style Map Q-sort to complete at their convenience and the scores were analyzed via a 5x2x2 completely crossed, randomized block factorial design in order to detect differences. There were significant differences among the three independent variables in the study. Moreover, interaction effects were found between educational levels, race, and sex within several cognitive modes, which shed doubt as to the validity of some of the detected differences.

Selected Statistical Methods and Procedures for Analyzing Educational Cognitive Style Interest Inventories

Reliability

A conceptual definition of reliability deals with the degree of consistency between two measures of the same thing (Mehrens & Lehmann, 1984). Synonyms for reliability are dependability, stability, consistency, predictability, and accuracy. If measurements are reliable, we can depend upon them.

Reliability is also concerned with the question of how much error of measurement there is in a measuring instrument, which is related to error variance. There are two general types of variance--systematic and random. Systematic variance leans in one direction, and the scores tend to be all positive or all negative, all high or all low. Errors in this case are constant and biased. Random or error variance occurs when scores tend to lean in many different ways. Errors of measurement are random errors. Based on these concepts, reliability can be defined as "the relative absence of errors of measurement in a measuring instrument" (Kerlinger, 1973, p. 443).

Basically, there are three concepts associated with reliability of measurement: (a) The concept of true and error scores, (b) the concept of true scores and parallel tests, and (c) the concept of domain sampling. They are related to one or more of four methods that may be employed to estimate the value of the reliability coefficient.

Four of the methods for estimating reliability are (a) the test-retest approach; (b) parallel- or equivalent-forms method; (c) split-halves method, and (d) the Kuder-Richardson method, or the method of intercorrelations among elements of an instrument.

The test-retest method requires two administrations of the same instrument to the same group of students. The degree of relationship between the group's paired scores is indicated by a correlation coefficient. The equivalent-form method of measuring reliability avoids the problem of time intervals between test administrations. Two equivalent forms of the instrument must be constructed and they should be similar in content, difficulty format, and number of items. The group being tested takes one form of the test, and then the other form. The split-halves method of estimating reliability divides the items of a single test into halves of "odd-numbered" and "even-numbered" items (Hill & Kerber, 1967).

The Kuder-Richardson method, which was used to assess reliability in this study, estimates the internal consistency of a test. The number of items in the test, the variance of the total test, and the arithmetic mean of the total test scores are the values required for this method. Mehrens and Lehmann (1984) indicate that measuring the internal consistency of a test by using reliability coefficients can be possible from only one set of test data. They also state that "these estimates are really indices of

the homogeneity of the items in the test, or the degree to which the item responses correlate with the total test score" (p. 274).

Hill and Kerber (1967) established the following factors affecting such aspects of reliability as length of test, range of student talent, and testing conditions:

1. The reliability of a test increases with an increase in the length of the instruments.

2. The reliability of a test approaches a limiting value with an increase in the length of instrument.

3. The curve of increase in reliability flattens out with continued lengthening of the test.

4. Restriction in the range of talent lowers the reliability of a test.

5. Greater variability in student talent results in a higher value of the reliability coefficient.

6. Conditions of administering and scoring a test may increase or decrease its reliability coefficient.

The Kuder-Richardson "20" or KR-20 is a formula for estimating homogeneity which yields a coefficient equal to the mean of all the possible split-half coefficients of the test. If the items (elements) of an instrument yield dichotomous data, e.g., answers that are "right," or "wrong," "yes" or "no" then the formula is as follows:

$$r_{20} = \frac{n}{n - 1}\left[1 - \frac{\Sigma s_i^2}{s_t^2}\right] \qquad (1)$$

where

n = number of items in the test,

= "the sum of,"

p = proportion of students answering "right" or "yes,"

q = proportion of studens answering "wrong" or "no."

The value of the standard deviation of the distribution of scores yielded by the instrument should be given along with the value of its reliability coefficient. A generalization of the KR-20 formula when the items are not scored dichotomously is the formula developed by Cronbach (1951). A relatively simple method for computing the approximate value of the reliability coefficient associated with this approach is represented by the formula:

$$\alpha = \frac{k}{k - 1}\left[1 - \frac{\Sigma s_i^2}{s_t^2}\right]$$

which provides a good approximation for the analyses of data in this study. A description of this formula is provided in Chapter 3.

Validity

Validity is concerned with the question of what is being measured. It is possible to study reliability without considering the meaning of variables; in contrast, for a test to be valid, or truthful, it must first be reliable (Whitla, 1968).

The most important classification of validity has been reported in the Standards for Educational and Psychological Tests and Manuals (French & Michael, 1966) delimiting three types of validity: (a) content validity, (b) criterion-related validity, (c) construct validity.

Although these approaches have some differences in purposes and goals, they tend to intersect mainly in meaning and their implications (Hill & Kerber, 1967).

Content validity is related to how adequately the content of the test samples the domain about which inferences are to be made (Mehrens & Lehmann, 1984). It has also been termed "logical validity" and "face validity," and is determined by the relevance of a test to different types of criteria such as analyses of courses of study and jobs, analyses of test questions, and logical analyses of mental processes and behaviors.

Criterion-related validity pertains to the empirical technique of studying the relationship between the test scores and some independent external measures (criteria). The two types of criterion-related validity are concurrent validity and predictive validity. The only procedural distinction between these pertains to the time period in which the criterion data are gathered (Mehrens & Lehmann, 1984). Concurrent validity is determined on the basis of how well instrument scores correspond to already accepted standards. Predictive validity is determined by evaluating how well predictions made from data gathering instruments

are confirmed by evidence collected at a later time (Hill & Kerber, 1967).

In a general sense, the predictive, concurrent, and content validity of an instrument pertain to an assessment of the extent to which the instrument measures the aspects it was designed to measure. The construct validity of an instrument is concerned with assessing which aspects are measured by the instrument. It is the latter context in which Educational Sciences is addressed, and in which this study makes its contribution.

Construct validity refers to the degree to which the test scores can be accounted for by certain explanatory constructs in a psychological theory. If an instrument has construct validity, scores will vary, as the theory underlying the construct would predict (Mehrens & Lehmann, 1984). The test constructor wants to know what psychological traits or elements in his or her study can explain the variance of the test. Thus, he or she wishes to know the meaning of the test and seeks to explain individual differences in the test scores of a measuring instrument. In short, how one can study these meanings is a construct validity problem. The significant point about construct validity is its concern with theory, theoretical construct, and scientific empirical inquiry involving the testing of hypothesized relations (Kerlinger, 1973).

Understanding what is involved in the validation of tests carries some implications for test users. The degree

of construct validity of an instrument cannot be expressed by any single quantitative index such as the value of a validity coefficient, nor can analysis of the nature and content of the instrument involved provide all the needed information; it should include descriptive verbal terms (subjective component) and must be presented by a combination of indices (Hill, 1981). Another implication is that, whenever possible, a test should be validated in the specific situation in which it is to be employed, and should be tested for its usefulness for a given purpose.

For the majority of possible uses of a test, validation inevitably becomes the responsibility of the test user. Thus the interpretability of a test score depends on its meaningfulness (Ebel, 1961). This has been explained by Cronbach (1960) stating that "the more fully and confidently a test can be interpreted, the greater its validity" (p. 1551). Finally, whether one wishes to use tests in practical situations or in pure research, one should always consider that one´s ideas about what the traits are as well as what the test measures must change as new evidence surfaces (Tyler & Walsh, 1979).

Reliability and Validity Coefficients of Educational Cognitive Style Interest Inventories

A few sources concerning reliability and validity coefficients of ECSIIs will be examined in this section. This researcher found only three dissertations mentioning

reliability and validity coefficients that were calculated based upon subjects´ performance on the Oakland Community College Test and Performance Battery (Crowe, 1975; Lipson, 1975; Robbins, 1977). They employed the Kuder-Richardson method for determining reliability coefficients, and the biserial coefficient of correlation for determining the discriminative power of an item and total instrument (validity index).

The Kuder-Richardson method was described previously; therefore, a brief description of the biserial coefficient of correlation (r_{bis}) method will be provided. Using this method, the test constructor will determine the discriminative power of items included in an instrument in which the items could be answered "right" or "wrong," or "yes" or "no." Hill (1981) provides a rationale for the discriminative power of items which is also called validity index:

> The rationale for the discriminative power of items included in a data collection instrumentality is based on the assumption that a different quality or magnitude of response should be expected from individuals or groups of individuals. For example, pupils of superior ability in mathematics should answer a difficult item on a mathematics test correctly more frequently than students with little mathematical ability. (p. 249)

Garrett (1958) considered the biserial coefficient of correlation as the standard procedure for determining the discriminative power of items. He recommended using a technique developed by Flanagan (1939) based on the top and

bottom 27 percent of the distribution scores, respectively. After the value of each item's r_{bis} has been calculated, an average value of r_{bis} may be determined for the total instrument (Hill, 1981).

The Kuder-Richardson reliability coefficients determined for an OCCII were reported by Lipson (1974). He employed a sample of 17 eighth graders in social studies. Lipson's study was regarded as exploratory since the sample size was small (n<30). The value of the Kuder-Richardson reliability coefficient was calculated by the Computation Center of the Oakland County Intermediate School District, and was found to be $r_{xx} = .70$. Lipson also reported validity indices (r_{bis}) for each element of OCCII, ranging from .54 to .93.

> The validity indices (point biserial correlation coefficients) for each of the elements included in the Oakland Community College Interest Inventory are:
>
> T(VL): $r_{bis} = .67$ Q(CKH): $r_{bis} = .93$
> T(AL): $r_{bis} = .93$ Q(p) : $r_{bis} = .93$
> T(VQ): $r_{bis} = .54$ Q(CS) : $r_{bis} = .77$
> T(AQ): $r_{bis} = .67$ Q(CT) : $r_{bis} = .77$
> Q(CEM): $r_{bis} = .93$ I : $r_{bis} = .93$
> Q(CES): $r_{bis} = .93$ A : $r_{bis} = .93$
> Q(CET): $r_{bis} = .93$ F : $r_{bis} = .93$
> Q(CH): $r_{bis} = .84$ M : $r_{bis} = .93$
> Q(Ck): $r_{bis} = .77$ D : $r_{bis} = .93$ (p.58)

Robbins (1976) made a comparison study of differences of educational cognitive style elements across educational levels, race and sex of college students. The 696 subjects were freshmen, sophomores, juniors, seniors, and graduate students selected at random from a population in all subject areas at Mountain View Community College, Dallas, Texas, and psychology and counseling courses at East Texas State University. The instrument was the Q-sort modified version of the Oakland Educational Cognitive Style Interest Inventory. According to Robbins, reliability and validity coeficients concerning the four elements T(VL), T(VQ), T(AL), T(AQ) were determined. Point biserial correlation coefficients showed a range from .61 to .80. The reliability coefficient for the entire inventory that provides results for the mapping of these elements of style was .81.

In another study, Crowe (1975) compared educational cognitive styles of selected students from vocational programs, to determine if sex bias exists. Validity indices and reliability coefficients were calculated for the sample of subjects' performance on the OCC Test and Interest Battery, and the Career Maturity Inventory. Crowe administered the tests to 17 males and 17 females of Hazel Park High School in 1974. Referring to the sample size, Crowe states, "since the present study is exploratory in nature and is thus not concerned with collecting a large number of cases for the purpose of statistical validation,

the size of the sample employed can be relatively small," but she adds, "a sample size of n<30 could be considered sufficient for the purpose of the study" (1974, p. 67). In Crowe's study the Kuder-Richardson formula was employed to determine reliability coefficients; the data processed at Oakland Schools revealed a reliability coefficient of .81 (p. 78). The validity indexes (r_{bis}) varied from .54 to .93, and the average validity index for the battery was r_{bis} = .783 .

Crowe found the following validity index for each element:

T(AL) : r_{bis} = .84	Q(CP): r_{bis} = .68
T(VQ) : r_{bis} = .93	Q(CS): r_{bis} = .84
T(AQ) : r_{bis} = .93	Q(CT): r_{bis} = .84
T(VL) : r_{bis} = .77	I : r_{bis} = .93
Q(CEM): r_{bis} = .77	F : r_{bis} = .54
Q(CES): r_{bis} = .93	A : r_{bis} = .54
Q(CET): r_{bis} = .84	M : r_{bis} = .68
Q(CH) : r_{bis} = .93	D : r_{bis} = .54
Q(CK) : r_{bis} = .84	R : r_{bis} = .68
Q(CKH): r_{bis} = .68	L : r_{bis} = .93 (p. 77)

These three researchers employed the same method for determining reliability, that is, Kuder-Richardson correlation coefficients. In the case of validity coefficients, those researchers used the method suggested in two letters written to or from Oakland Community College (copies are located in Appendix C). Although they found

similar item validity indices, if one compares the variables independently [e.g., T(VQ), T(AQ), (F), (A), (D)] , their results differ among the studies. Moreover, the sample size in the three studies appears to be too small for determining reliability and validity coefficients (Guertin & Bailey, 1970).

In another study, Doney (1980) correlated the Myers-Briggs Type Indicator (MBTI) with the OCC Cognitive Style Map Interest Inventory (OCCII) to determine if they were measuring similar individual traits. The student population came from seven high schools and two junior colleges in the state of Florida. The sample population of 172 students consisted of one class randomly selected from each of the participating schools. Doney found a lack of relationship between the two instruments, concluding that they measure independent traits. He states:

> The Jungian approach is intuitive and seeks to find the inner motivations of individuals . . . The Hill approach is empirical and provides various approaches to cognitive understanding of one´s world. (pp. 95-96)

However, Doney did not report reliability and validity coefficients for the interest inventory he used. Doney also pointed out that further research is suggested on methodology for determining reliability and external validity of educational cognitive style instruments in order to establish any relationships to MBTI variables.

Factor Analysis

This section will refer to a brief history and the use of factor analysis in determining the structure of the ECSII. Around the turn of this century the principal contributors to the foundation of factor analysis included Charles Spearman, Cyril Burt, Karl Pearson, Godfrey H. Thomas, J.C. Maxwell Garnett, and Karl Holzinger. The origin of factor analysis is ascribed to Charles Spearman (1904) who developed a psychological theory about human intelligence involving a single general factor and a number of specific factors. He labored the last 40 years of his life with the development of this statistical method and has been regardes as the "father of factor analysis" (Harman, 1976, p. 3).

Although some very effective methods of analysis were developed in the 1930s and 1940s, such as Thurstone´s Multiple-factor Theory, a good deal of effort was oriented toward the reduction of labor of computation. Then with the availability of high-speed electronic computers in the 1950s, many of the existing problems in factor analysis began to be solved.

Kerlinger (1973) defined factor analysis as a "method for determining the number and the nature of the underlying variables among larger numbers of measures. It may also be called a method for extracting common factor variances from sets of measures" (p. 659).

Guertin and Bailey (1970) also provide another definition of factor analysis as "a formal decision-making process to explicate subsets of covarying variables no matter how numerous they may be" (p. 1).

Factor analysis is essentially different in kind and purpose from other multivariate methods such as multiple regression analysis, canonical correlation analysis, and discriminant analysis (Kerlinger, 1973). The chief characteristic among these methods is the simultaneous analysis of *k* independent variables and *m* dependent variables; however, the fundamental purpose of factor analysis is to help the researcher "discover and identify the unities, or dimensions, called factors, behind many measures" (Kerlinger, 1973, p. 150). A *factor* is a construct, a hypothetical entity, that is assumed to underlie tests, scales, items, or other kinds of measurement (Thurstone, 1948). Thus factor analysis can be conceived as a construct validity tool since it seeks the "meaning" of a construct through the relations between the variables under study.

A review of the Educational Cognitive Style Interest Inventory literature reveals that only one study has been done to determine the factor structure of the instrument. Sheriff (1978) used a version of Hill's ECSII at Mountain View Community College, Dallas, Texas, to delineate and identify those factors present within the area of measurement. Data on reliability coefficients were not

reported in this study. Sheriff did not find empirical evidence to support the theoretical structure of the instrument due to the finding of 5 factors instead of 27 factors as assumed by Sheriff.

Summary

A review of the literature shows that of the more than 100 doctoral dissertations related to Educational Cognitive Style, most have used college level samples. Very little effort was made to determine the reliability and validity of ECS interest inventories, especially for junior high school students. The design used in this study to assess reliability and validity of the ECSII as a preliminary step for further validation is described in Chapter 3.

CHAPTER 3
DESIGN OF THE STUDY

A validation study was conducted to determine the reliability and construct validity of the Educational Cognitive Style Interest Inventory (Form J-O). A self-report questionnaire was used for determining individual preferences of junior high school students (Appendix B).

The student population consisted of urban and rural students in central and north central Florida, respectively. The sample population was selected randomly according to sex, grade level, and geographical location of the schools.

Responses to the questionnaire were processed by computer, analyzed for internal consistency of the subscales, and then factor-analyzed to determine the internal validity of the instrument. A 2x2x2 factorial design was also used to determine differences in the responses of each of the subscales regarding sex, grade level, and school location.

Selection of the Subjects

Subjects in the target population came from a 7th-, 8th-, and 9th-grade urban student population in central Florida, and from a 6th-, 7th-, and 8th-grade rural student population in north central Florida. The sample collected from those schools over a period of two years (1983-84) was based upon accessibility. The sampling was considered adequate for the purposes of the present study (Krejcie & Morgan, 1970).

The sample was stratified on the bases of sex, grade level, and school location. The total amount of students in the sample was 811, and its distribution is presented in Table 1. The variance observed in the distribution is believed to provide the required heterogeneity.

Table 1

Sample Distribution According to Sex, Grade Level, and Location of Schools

Grade	Sex	
	Male	Female
	Urban Sample[a]	
7	194	204
8	60	57
9	72	53
	Rural Sample[b]	
6	40	41
7	29	23
8	15	23

$\underline{n}^a = 640$. $\underline{n}^b = 171$.

Instrumentation

The instrument used to gather the data was the self-report questionnaire, Educational Cognitive Style Interest Inventory (Form J-O) developed by Lee J. Mullally. This instrument was derived from the Educational Cognitive Style Interest Inventory adult version developed by Hill (n.d.), Oakland Community College, Michigan. The adaptation of this instrument to the junior high school level was made in cooperation with the Stow City school teachers in Stow, Ohio during 1976-78. The test showed a 6.8 readability level as measured by the Flesch Readability Formula (L. J. Mullally, personal communication, January 5, 1984).

The Educational Cognitive Style Interest Inventory (described in Chapter 1), is comprised of 27 subscales. The total inventory contains 216 items distributed as eight items per subscale (Table 2).

Data Collection and Processing

Each classroom teacher administered the Educational Cognitive Style Interest Inventory (Form J-O) by reading the following paragraph presented on the cover sheet of the questionnaire (see Appendix B).

> This interest inventory will be used to show how you seek meaning from the world around you. This is a self-report and not a test. There are no "good" nor "bad" styles.

Table 2

Distribution of Items per Subscale of the Educational Cognitive Style Interest Inventory (Form J-O)

SCALE I: Symbols and their Meanings:	
T(AD)- Theoretical Auditory Linguistics -	1, 28, 55, 82, 109, 136, 163, 190
T(AQ)- Theoretical Auditory Quantitative-	2, 29, 56, 83, 110, 137, 164, 191
T(VL)- Theoretical Visual Linguistics-	3, 30, 57, 84, 111, 138, 165, 192
T(VQ)- Theoretical Visual Quantitative-	4, 31, 58, 85, 112, 139, 166, 193
Q(A) - Qualitative Auditory	5, 32, 59, 86, 113, 140, 167, 194
Q(Q) - Qualitative Olfatory-	6, 33, 60, 87, 114, 141, 168, 195
Q(S) - Qualitative Savory-	7, 34, 61, 88, 115, 142, 169, 196
Q(T) - Qualitative Tactile-	8, 35, 62, 89, 116, 143, 170, 197
Q(V) - Qualitative Visual-	9, 36, 63, 90, 117, 144, 171, 198
Q(P) - Qualitative Proprioceptive-	10, 37, 64, 91, 118, 145, 172, 199
Q(CEM)-Qualitative Code Empathetic-	11, 38, 65, 92, 119, 146, 173, 200
Q(CPS)-Qualitative Code Esthetic-	12, 39, 66, 93, 120, 147, 174, 201
Q(CET)-Qualitative Code Ethic-	13, 40, 67, 94, 121, 148, 175, 202
Q(CH)- Qualitative Code Histrionic-	14, 41, 68, 95, 122, 149, 176, 203
Q(CK)- Qualitative Code Kinesics-	15, 42, 69, 96, 123, 150, 177, 204
Q(CKH)-Qualitative Code Kinesthetic-	16, 43, 70, 97, 124, 151, 178, 205
Q(CP)- Qualitative Code Proxemics-	17, 44, 71, 98, 125, 152, 179, 206
Q(CS)- Qualitative Code Synnoetics-	18, 45, 72, 99, 126, 153, 180, 207
Q(CT)- Qualitative Code Transactional-	19, 46, 73,100, 127, 154, 181, 208

Table 2 - continued

SCALE II: Cultural Determinants	
A-Associates-	20, 47, 74, 101, 128, 155, 182, 209
F-Family or Authoritative Figure-	21, 48, 75, 102, 129, 156, 183, 210
I-Individuality-	22, 49, 76, 103, 130, 157, 184, 211

SCALE III: Modes of Inference	
D-Difference	23, 50, 77, 104, 131, 158, 185, 212
L-Appraisal	24, 51, 78, 105, 132, 159, 186, 213
M-Magnitude	25, 52, 79, 106, 133, 160, 187, 214
R-Relationship	26, 53, 80, 107, 134, 161, 188, 215
K-Deductive	27, 54, 81, 108, 135, 162, 189, 216

> Different tasks require different styles. Educational Cognitive Style Mapping shows the ways in which you can be a successful student. (Appendix B)

Then the teacher read the next page of the booklet, which includes directions on how to record responses on the computer sheet provided. Then the students were directed to read each of the 216 statements and decide whether each statement "usually," "sometimes," or "rarely" reflected their particular preferences. Teachers asked their students to complete the entire inventory. Although it takes approximately one hour to complete, the students were provided with time to complete the questionnaire without restrictions.

The students´ responses recorded on the computer sheet were transferred to a computer tape via a reader scanner available at the Office of Instructional Resources (OIR), University of Florida. Each of the responses was recorded as A = usually, B = sometimes, or C = rarely. Each letter was assigned a numerical value of 5, 3, and 1, respectively. A final score was generated for each of the 27 subscales by adding all eight items´ numerical value per subscale, and then considering the total sum as an index value for that particular subscale. As an example,

$$ST(VL) = T(VL)1 + T(VL)2 + T(VL)3 + T(VL)4 + T(VL)5 + T(VL)6 + T(VL)7 + T(VL)8$$

where

ST(VL) = index value corresponding to the sum of eight items´numerical value per student.

T(VL) = numerical value of item i per student per subscale T(VL).

Higher index values in T(VL) correspond to a "strength" for the student´s preferred way to get meaning through written words; lower index values indicate a "weakness" or low preference for that particular attribute.

Data Analysis

The Educational Cognitive Style Interest Inventory responses, recorded and stored on a computer tape, form a matrix of 216 items across the horizontal axis by 811 respondees down the vertical axis of the matrix. This matrix of responses was processed by an IBM computer at the Northeast Regional Data Center, University of Florida, Gainesville, Florida, and by an IBM computer at Contraloria General, Panama, Republic of Panama.

The 811 interest inventories were analyzed to derive means, standard deviations, correlation coefficients, and reliability coefficients. This information was used for further factor analysis and group differences analysis. A description and a rationale for using statistical techniques are included.

Correlational Techniques

There are many kinds of correlational techniques, such as the product-moment coefficient of correlation (r), the rank-order coefficient of correlation (rho), the distance measure (D), the coefficient of contingency (C), and the coefficient of multiple correlation (R). Kerlinger (1973) indicates that "almost all coefficients of relation, no matter how different in variation, appearance, calculation, and use, do essentially the same thing. They express the extent to which the pairs of sets of ordered pairs vary concomitantly" (p. 145). These coefficients indicate the magnitude of the linear relationship between scores. They vary in value from -1.00 through 0 to +1.00; with -1.00 and +1.00 indicating perfect negative and positive association, respectively. A correlation of 0.00 indicates no relationship between variables.

The most commonly used correlational technique is the product-moment correlation coefficient that was mathematically derived by Pearson. This coefficient (r) is a mathematical statement of the relationship between two sets of scores e.g., scores of T(AL) vs. scores of T(VL) , and is determined by using the following equation:

$$r_{xy} = \frac{\Sigma \; (d_x) \; (d_y)}{N \; (SD_x)(SD_y)}$$

where

d = deviation from the mean,

N = number of cases,

SD = standard deviation of the first set of scores,

SD = standard deviation of the second set of scores.

The Pearson product-moment correlational technique is used to assess the degree of relationship between two or more subscales. This information is used for determining how these subscales are related to each other, and to their respective scale as theoretically proposed. Since the data derived from the ECSII´s 3-point scales were considered to be continuous, the Pearson product-moment correlational technique was selected to be used in this study.

Program PEARSON CORR (SAS, 1985) was selected to calculate correlation coefficients among the 27 attributes or subscales assessed by the ECSII. The program yielded a square correlation coefficient matrix, containing 1.00 as the diagonal elements. This is considered not only as a direct estimate of the amount of variance shared by the variables but also as an estimate of the degree of the relationship among subscales.

Reliability

The inventory was tested for internal consistency. Reliability coefficients of the 27 subscales of the Educational Cognitive Style were calculated by using the Coefficient Alpha (α).

The researcher used the formula

$$\alpha = \frac{k}{k-1}\left[1 - \frac{\Sigma s_i^2}{s_t^2}\right] \qquad (2)$$

where

k = number of items,

s_i^2 = variance for item i,

Σs_i^2 = added variances of the eight items belonging to each subscale, e.g., for T(VL), $s_{i3}^2 + s_{i30}^2 + s_{i57}^2 + \ldots s_{i192}^2$

s_t^2 = variance of the total subscale, e.g., T(VL).

Prior to this study no reliability coefficients were available for the modified version of the ECSII (Form J-O).

Factor Analysis

One of the main purposes of the present study was to determine the factor structure of the Educational Cognitive Style Interest Inventory (Form J-O). Factor analysis is a multivariate statistical technique which assists test developers in understanding the interrelationships among many variables. This technique has become accessible with the availability of high-speed computers and with increased understanding of its uses in behavioral research.

Using factor analysis avoids the arbitrary selection of variables and provides a method for determining both

the degree of association between and among the variables involved. For identifying the essential entities composing the ECSII, Hill and Kerber (1967) outlined the basic procedure of the factor analytic process as follows:

> 1. Measurements are taken on an indefinite number of variables in a given problem area.
> 2. Selecting two variables at a time from the original set, and thus forming all the different combinations of two that are possible, a correlation coefficient is calculated for each of the respective pairs formed.
> 3. The set of correlation coefficients are placed in a matrix.
> 4. Employing procedures of matrix algebra, a multiple factor analysis method (centroid, or principle axes, or other methods) is carried out to extract factors from the original set of correlation coefficients.
> 5. The factor analytic technique shows how some variables might group together because of certain similarities, and at the same time delineates underlying, independent factors that may well be responsible for the groupings. (p. 460)

After the self-report questionnaire was administered and scored, coefficients of correlation were calculated among the 27 subscales scores to produce a correlation matrix. If two or more subscales of the ECSII are substantially correlated, then the subscales share variance; that is, they measure something in common. Correlation coefficient results were then factor analyzed.

In this study, a full component model was first done using Statistical Analysis System's principal factor analysis by the Method = PRIN (SAS, 1985). The squared multiple correlation (SMC) of the subscales was used as a prior communality estimate. After the initial factor

extraction, the common factors were then rotated by an oblique transformation, because it was considered that factors would be intercorrelated. The specification ROTATE = PROMAX was used because it provides both orthogonal and oblique transformation.

Group Differences

Group differences for each of the 27 subscales due to grade level and sex were determined. The research hypotheses for each subscale are stated in null form, and an explanation for the statistical analysis is given for the hypotheses.

Hypothesis 1. For each of the 27 subscales of the ECSII, there will be no significant differences between the 7th-, 8th-, and 9th-graders.

Hypothesis 2. For each of the 27 subscales of the ECSII, there will be no significant differences between males and females.

Hypothesis 3. For each of the 27 subscales of the ECSII, there will be no significant interaction between grade level and sex.

For the data analyses, a 3x2 factorial ANOVA was used with grade level (7th, 8th, 9th) and sex (male, female) as the first and the second independent variables. The

variables of interest were each of the 27 subscales of the ECSII, and the data came from the urban sample population of this study (*n* =640). A two-way ANOVA was used to compare groups along the two dimensions (grade level and sex). All *F* values were determined for significance at the alpha level of .05.

Hypothesis 4. For each of the 27 subscales of the ECSII, there will be no significant differences between urban and rural schools.

The same analytical procedure used in the data analyses for the Hypothesis 1, 2, and 3 was used for a comparison of groups (by grade and sex) but adding a third independent variable, school location (rural and urban). The procedure was limited to the differences at the 7th- and the 8th-grade level in both rural and urban samples, since the rural sample came from a middle school. A 2x2x2 ANOVA was used to analyze the data along the three dimensions. All *F* values were determined for significance at the alpha level of .05.

For a better understanding of the terms used in Chapter 4, some definitions and its application to the ECSII subscales are provided as follows:

A factor is a construct, a hypothetical entity, that is assumed to underlie tests, scales, items, and measures of almost any kind (Kerlinger, 1973, p. 660).

There are three types of factors. The general factor shows that all variables have sizable loadings on this factor. The group factor has only a few variables that load on the factor. A specific factor is illustrated where only one variable has a loading on the factor (Guertin & Bailey, 1970).

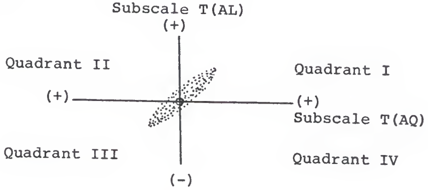
The correlation matrix is also called R Matrix. Correlation matrices are always square and symmetric because the lower half of the matrix below the diagonal (from upper left to lower right) is the same as the upper half of the matrix. For instance, a hypothetical R Matrix of four subscales of the ECSII would look like this:

	T(AL)	T(AQ)	Q(CEM)	Q(CET)
T(AL)	1.00	.80	.05	.10
T(AQ)	.80	1.00	.08	.10
Q(CEM)	.05	.08	1.00	.80
Q(CET)	.10	.10	.80	1.00

If two of these subscales, e.g., T(AL) and T(AQ), are correlated, then these two variables share variance in one factor, and Q(CEM) and Q(CET) in another factor.

Scatter diagram of correlation coefficient. A scatter diagram is used to represent correlations graphically. This can be done by "placing points for each pair of scores on a graph formed by employing, say, two tests as the two coordinate axes" (Hill & Kerber, 1967, p. 461).

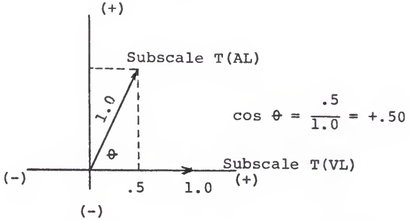
As an example, scores on subscale T(AL) combined with those on subscale T(AQ) for a given sample are provided as follows:



Through this representation, the positive correlation is indicated by the set of points presented in quadrants I and III of the graph. In other words, the responses in subscale T(AL) are associated with responses in subscale T(AQ); any high index value in one subscale will be related to any high index value on the other subscale.

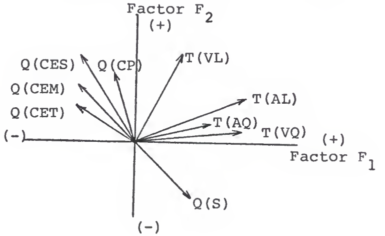
Vector representation of a correlation coefficient. A <u>vector</u> is a quantity having both magnitude and direction. Hill and Kerber (1967) indicate that a correlation coefficient can be represented geometrically as "the cosine function of an angle θ between two vectors, where the two vectors represent the value (magnitude) and direction of action of the two respective variables providing the correlation" (p. 461). As an example, cos θ = .50 becomes equal to product-moment correlation coefficient $\underline{r}$ = .50

between subscales T(AL) and T(VL). Therefore, the graphic representation is as follows:



If $\underline{r}$ = 0.00, the angular separation is 90°, e.g., they are orthogonal, which means there is no correlation between the two subscales. In the case that subscales are highly related (closely $\underline{r}$ =1.00), the angular separation tends to be 0°. Representing subscales' correlation coefficients as vectors allows a better understanding of factor analysis.

<u>Spatial model of the correlation.</u> Using appropriate computational procedures, each value of the correlation between two subscales may be found by the "cos θ." Subscale "vectors" are arbitrarily located in a selected origin; an example of a spatial representation of the correlation between all subscales could be as follows:



In this example, certain subscales may be isolated [T(VL) and Q(S)] ; others fall into clusters [T(AL, T(AQ), T(VQ), and Q(CEM), Q(CES), Q(CET), Q(P)] . The coordinate axes, OF_1 and OF_2 , are placed on the model after all the subscale vectors have been drawn in their position. The computer output provides a plot of the subscales relative position to each factor. Since it is impossible to represent graphically the vector results when having more than two factors, we should rely upon mathematical models.

Methods of factor analysis. There are a number of methods for factor analyzing a correlation matrix. The predominant method at present, and one that has computer programmable potential, is the principal factor method. This method is mathematically satisfying since it yields a unique solution to a factor problem. Perhaps its major feature is that it extracts a maximum amount of variance as each factor is calculated. That is, the first factor extracts the most variance, the second the next most variance, and so on. Variables or subscales that are highly and positively correlated should be near each other and away from variables with which they do not correlate (Kerlinger, 1973, pp. 667-670).

Factor matrices. One of the final outcomes of a factor analysis is called factor matrix, which is a table of correlation coefficients between the subscales and the underlying factors. A hypothetical example of a factor matrix is provided as follows:

	Factor		
Variable	I	II	h
T(AL)	.70	.10	.50
T(AQ)	.50	.10	.26
Q(CEM)	.10	.60	.37
Q(S)	.60	.20	.40
A	.20	.50	.29
Q(CET)	.10	.60	.37
Eigenvalue	1.16	1.03	2.19

Factor loadings represent product-moment r´s between the scores on the subscale and each of the two factor scores. Factor loadings as with correlation coefficients range from -1.00 through 0 to +1.00. If a subscale measures one factor only, it is to said to be "factorially pure." If a subscale contains more than one factor, it is to said to be "factorially complex" (Kerlinger, 1973, pp. 661-665). In the example above, subscale T(AL) has a factor loading of .70 on the first factor and a loading of .10 on the second factor. In this case, T(AL) correlates highly with factor I but not with factor II. Another subscale, such as T(AQ) has a factor loading of .50 on the first factor but only .10 on the second factor; T(AQ) and T(AL) are measuring something in common. The same is true between subscales Q(CEM) and Q(CET) which load on factor II but not on factor I; these two subscales are measuring something in common.

The eigenvalue is the portion of variance of the subscales that is common with the factor. Eigenvalue is

calculated by squaring and summing each subscale's loading on a factor [e.g., eigenvalue for factor I, = $(.7)^2 + (.5)^2 + (.1)^2 + (.6)^2 + (.2)^2 + (.1)^2 = 1.16$].

The communality is also called h and is calculated by summing the squares of the factor loadings of a subscale or variable, corresponding to its common factor variance. In the example, h^2 for subscale T(AL) = $(.7)^2 + (.1)^2 =$ .50, that is, subscale T(AL) loads, or shares variance with other subscales in factor I and factor II.

Rotation solution. Many writers argue that it is necessary to rotate factor matrices if one expects to interpret them adequately and to provide meaningful structures. If factors are uncorrelated then the orthogonal rotation is the best approximation to find out which subscales load on each factor. Some researchers believe that this rotation is unrealistic because actual factors are not usually uncorrelated, and rotations should conform to psychological "reality." Rotations in which the factors are allowed to form acute (less than 45°), or oblique (greater than 90°) angles, are called oblique rotations. Obliqueness means that factors or scales are correlated, which provides meaningfulness if one is interested in factor structures (Kerlinger, 1973).

Summary

In order to answer the questions addressed in Chapter 1, responses to the questionnaire were processed by computer, analyzed for internal consistency of the subscales, and factor-analyzed to determine the validity of the instrument. A 3x2 factorial design was also used to determine differences in the responses of each of the subscales regarding grade level and sex. A third variable was added, school location, the results will be discussed in Chapter 4.

CHAPTER 4
RESULTS AND DISCUSSION

The main purpose of this study was to determine the reliability and validity of the Educational Cognitive Style Interest Inventory (Form J-O) for junior high school students. Reliability was assessed by examining the ECSII subscales´ internal consistency, and construct validity was assessed by examining the factor structure of the ECSII. The first section of this chapter deals with descriptive statistics, and the other sections are organized in accordance with the research questions addressed in Chapter 1:

1. Are the ECSII´ subscales internally consistent?

2. What is the factor structure of the ECS Interest Inventory Form J-O?

3. To what extent are the subscales concerning symbols and their meanings correlated to Hill´s scale I?

4. To what extent are the subscales concerning cultural determinants correlated to Hill´s scale II?

5. To what extent are the subscales concerning modalities of inference correlated to Hill´s scale III?

6. What are the relationships among educational cognitive style subscales and students´ sex, grade level, and school location?

Descriptive Statistics

The means and standard deviations for males and females, separately and together, for each of the 27 subscales of the ECSII for the total sample (*N* =811), urban sample (*n* =640), and rural sample (*n* =171), are presented in Table 3, 4, and 5, respectively. The means for the total sample varied from 26.05 to 30.88 and the standard deviations varied from 4.62 to 6.42 (Table 3). Means for the urban sample varied from 26.03 to 30.46 and the standard deviations varied from 4.64 to 6.30 (Table 4). The means for the rural sample varied from 25.18 to 32.87 and the standard deviations varied from 4.33 to 5.71 (Table 5).

The results showed less variability in the scores for the rural sample (Table 5) than the urban sample (Table 4). There is also less variability on scores for females in both samples when compared with males. In general, this could indicate more group homogeneity in their responses. The implications of differences among groups will be discussed later.

Table 3

Means and Standard Deviations of ECSII's Subscales of Total Sample

Subscale	Total[a] M	Total[a] SD	Males[b] M	Males[b] SD	Females[c] M	Females[c] SD
T(AL)	27.46	4.89	27.70	4.92	27.29	4.85
T(AQ)	26.08	5.29	26.06	5.35	26.10	5.24
T(VL)	26.91	5.44	26.21	5.66	27.65	5.11
T(VQ)	26.20	5.42	26.45	5.37	25.92	5.46
Q(A)	28.98	5.06	28.84	5.23	29.15	4.87
Q(S)	30.97	5.50	30.72	5.76	31.22	5.21
Q(O)	29.12	5.89	28.29	6.04	30.01	5.59
Q(T)	30.88	5.42	30.67	5.83	31.12	4.95
Q(v)	27.17	4.79	27.40	5.01	26.92	4.56
Q(P)	27.01	5.30	27.32	5.38	26.69	5.22
Q(CEM)	28.61	5.10	27.72	5.27	29.56	4.73
Q(CES)	27.96	5.80	26.65	5.91	29.31	5.37
Q(CET)	29.39	5.60	28.78	5.39	30.02	5.76
Q(CH)	27.02	6.10	27.00	5.97	27.04	6.26
Q(CK)	26.05	5.03	25.52	5.34	26.59	4.64
Q(CKH)	26.78	5.32	26.81	5.26	26.75	5.40
Q(CP)	27.57	4.62	27.15	4.74	28.01	4.44
Q(CS)	29.14	5.20	28.93	5.45	29.36	4.92
Q(CT)	26.84	5.31	26.35	5.47	27.34	5.09
A	27.16	5.35	26.29	5.39	28.06	5.17
F	28.88	6.42	28.38	6.51	29.41	6.30
I	27.83	5.01	27.84	5.52	27.81	4.43
D	26.81	4.85	26.51	4.90	27.14	4.80
L	29.51	5.18	29.44	5.18	29.57	5.07
M	28.17	5.13	28.14	5.17	28.19	5.10
R	26.56	5.06	26.92	5.28	26.18	4.80
K	27.38	5.46	27.74	5.69	27.02	5.20

n[a] = 811. x n[b]= 401. x n[c]= 410.

Table 4

Means and Standard Deviations of ECSII's Subscales of Urban Sample

Subscale	Total[a] M	Total[a] SD	Males[b] M	Males[b] SD	Females[c] M	Females[c] SD
T(AL)	27.58	4.96	28.14	5.12	27.71	4.56
T(VQ)	26.11	5.35	26.79	5.59	27.57	4.85
T(VL)	26.80	5.48	26.62	5.59	28.07	5.07
T(VQ)	26.03	5.39	26.64	5.61	26.19	5.13
Q(A)	28.78	5.17	29.02	4.99	29.61	4.73
Q(S)	28.77	6.04	31.10	5.29	29.16	4.75
Q(O)	30.46	5.61	27.65	6.21	28.45	4.72
Q(T)	30.38	5.47	30.58	5.79	30.44	4.56
Q(V)	27.00	4.89	27.41	5.27	27.40	4.18
Q(P)	27.08	5.40	27.78	5.38	27.35	4.55
Q(CEM)	28.73	5.17	28.34	5.13	30.24	4.69
Q(CES)	27.99	5.84	27.29	5.76	30.00	5.08
Q(CET)	29.02	5.62	28.71	5.43	29.78	5.77
Q(CH)	27.36	6.28	28.22	5.95	28.83	5.18
Q(CK)	26.27	5.05	25.69	5.38	26.81	4.60
Q(CKH)	26.61	5.38	26.56	5.27	26.43	5.78
Q(CP)	27.43	4.64	27.48	4.79	27.77	4.78
Q(CS)	28.87	5.27	29.19	4.95	29.43	4.51
Q(CT)	27.05	5.31	27.06	5.49	28.15	4.60
A	27.19	5.43	26.38	5.45	28.26	4.89
F	28.11	6.30	27.50	6.50	27.88	6.20
I	27.64	5.06	28.18	5.66	28.15	4.04
D	26.55	4.91	26.71	4.56	27.12	4.69
L	29.65	5.19	29.71	5.00	30.04	4.60
M	28.12	5.32	28.85	5.13	29.37	5.37
R	26.72	5.04	27.83	5.18	27.48	4.17
K	27.56	5.57	29.27	5.81	29.00	5.01

n^a = 640. n^b = 326. n^c = 314.

Table 5

Means and Standard Deviations of ECSII's Subscales of Rural Sample

Subscale	Total[a] M	Total[a] SD	Males[b] M	Males[b] SD	Females[c] M	Females[c] SD
T(AL)	27.00	4.59	27.22	4.51	26.78	4.67
T(AQ)	25.94	5.08	26.55	5.24	25.34	4.87
T(VL)	27.36	5.28	26.89	5.99	27.81	4.48
T(VQ)	26.85	5.47	27.09	5.51	26.63	5.45
Q(A)	29.79	4.51	30.36	4.58	29.24	4.40
Q(O)	32.98	4.54	33.14	4.59	32.83	4.52
Q(S)	30.49	5.05	30.70	4.87	30.28	5.24
Q(T)	32.87	4.71	32.73	5.49	33.00	3.85
Q(V)	27.85	4.33	28.11	4.37	27.59	4.30
Q(P)	26.75	4.91	27.69	5.06	25.85	4.62
Q(CEM)	28.15	4.79	27.66	5.50	28.62	3.96
Q(CES)	27.83	5.68	26.84	6.36	28.79	4.79
Q(CET)	30.84	5.31	30.39	5.35	31.28	5.27
Q(CH)	25.69	5.14	26.00	5.34	25.40	4.96
Q(CK)	25.18	4.90	25.02	5.34	25.34	4.47
Q(CKH)	27.45	5.05	27.60	5.36	27.31	4.75
Q(CP)	28.12	4.53	27.39	5.26	28.82	3.59
Q(CS)	30.20	4.78	30.27	5.04	30.13	4.55
Q(CT)	26.00	5.21	25.80	5.31	26.19	5.12
A	27.02	5.07	26.50	4.98	27.54	5.12
F	31.92	5.71	31.58	5.94	32.25	5.50
I	28.54	4.76	28.47	5.17	28.62	4.34
D	27.84	4.50	27.60	4.87	28.08	4.12
L	28.94	5.11	29.01	5.83	28.87	4.33
M	28.33	4.30	29.01	4.51	27.67	4.01
R	25.93	5.08	26.78	5.25	25.11	4.80
K	26.69	4.97	26.91	5.29	26.47	4.66

$n^a = 171$. $n^b = 84$. $n^c = 87$.

Reliability

Cronbach´s alpha reliability coefficients were calculated for determining the internal consistency of the ECSII subscales. The results for total, urban, and rural samples are summarized in Tables 6, 7, and 8, respectively.

Internal Consistency of the ECSII Subscales

An analysis of the data revealed reliability coefficients for the entire inventory, ranging from .2579 on the subscale Q(CP), to a .7059 on the subscale (F) (see Table 6). Although these reliabilities are low for individual predictions and measurements, they are generally high enough to permit use for evaluation of group differences (Nicewander & Price, 1978).

As illustrated in Tables 6 and 7, the alpha reliability coefficients of the rural sample were lower than those of the urban sample. These results are congruent with the heterogeneity of the groups (urban > rural) and the number of subjects in the samples (urban > rural). Reliability increases with group heterogeneity and the number of subjects in the study (Guertin & Bailey, 1970).

Alpha reliability coefficients among males and females also varied according to the number of subjects in the samples. That is, reliability coefficients for males in the urban sample (Table 7) were higher than those in the

Table 6

Cronbach's alpha Reliability Coefficients of ECSII's Subscales for Total Sample

Subscale	Total[a]	Males[b]	Females[c]
T(AL)	.3501	.3463	.3529
T(AQ)	.4506	.4464	.4600
T(VL)	.4677	.4823	.6164
T(VQ)	.4922	.4630	.5228
Q(A)	.4496	.4621	.4387
Q(O)	.5148	.5413	.4889
Q(S)	.6648	.6700	.6376
Q(T)	.5431	.6155	.4452
Q(V)	.2947	.3290	.2654
Q(P)	.4562	.4611	.4726
Q(CEM)	.4973	.5043	.4513
Q(CES)	.5933	.5911	.5471
Q(CET)	.5682	.5088	.6157
Q(CH)	.6023	.5740	.6321
Q(CK)	.3959	.4386	.3284
Q(CKH)	.4408	.4227	.4893
Q(CP)	.2579	.2466	.2630
Q(CS)	.5515	.5831	.5160
Q(CT)	.5368	.5414	.5293
A	.5534	.5271	.5648
F	.7057	.7069	.7027
I	.4750	.5440	.3525
D	.3465	.3269	.3666
L	.5603	.5594	.5625
M	.5148	.4938	.5404
R	.4350	.4856	.3801
K	.5578	.5836	.5142

$\underline{n}^a$ = 811. $\underline{n}^b$ = 401. $\underline{n}^c$ = 410.

Table 7

Cronbach's alpha reliability coefficients of ECSII'S subscales for Urban Sample

Subscale	Total[a]	Male[b]	Female[c]
T(AL)	.3738	.4375	.3355
T(AQ)	.4591	.5526	.4845
T(VL)	.4642	.5615	.5277
T(VQ)	.4773	.5788	.5748
Q(A)	.4620	.4212	.4626
Q(O)	.6089	.4363	.3658
Q(S)	.6004	.7443	.5346
Q(T)	.5421	.6333	.3521
Q(V)	.3119	.4349	.2759
Q(P)	.4726	.5718	.3958
Q(CEM)	.5044	.5174	.4890
Q(CES)	.5844	.5900	.4939
Q(CET)	.5595	.5630	.6694
Q(CH)	.6241	.6268	.5298
Q(CK)	.3912	.4728	.3194
Q(CKH)	.4426	.4577	.6090
Q(CP)	.2351	.3276	.4319
Q(CS)	.5492	.5223	.4515
Q(CT)	.5358	.5620	.4545
A	.5636	.5580	.5255
F	.6881	.7274	.7120
I	.4770	.6064	.3055
D	.3493	.2693	.3570
L	.5597	.5132	.4975
M	.5519	.4628	.6192
R	.4178	.5128	.2686
K	.5811	.6759	.5451

$\underline{n}^a$ = 640. $\underline{n}^b$ = 326. $\underline{n}^c$ = 314.

rural sample (Table 8); the same occurs when comparing males and females in both samples (males > females). This could be explained by a decrease in chance errors of measurement when the n increases from 171 (rural sample), to 640 (urban sample), to 811 (total sample).

With the total sample (Table 6), alpha reliability coefficients were consistently similar except for subscales T(VL), Q(T), Q(CET), (I), and (R). One possible explanation for the difference among alpha coefficients for males and females is the low variability found in some of the items. For instance, in a subsample (n=21), some individual statements on the ECSII consistently demonstrated low variability (ranging from 3 to 5), in both males [T(VL)2, Q(S)5, Q(CEM)3, Q(CEM)7, Q(CS)8], and females [T(AQ)3, T(VL)1, T(Vl)3, Q(A)2, Q(A)8, Q(S)8, Q(CEM)7, Q(CES)5, Q(CS)8, Q(CET)4, Q(CK)4, Q(CK)7, I1, I3, R7, K1] . In addition, three items did not present any variability between females of the same subsample Q(S)1, I5, R8 .

Relationships among ECSII Subscales

The results of the product-moment correlation coefficients among the 27 subscales are presented in Table 9. Significant positive coefficients were detected among all subscales ($p<.001$).

Table 8

Cronbach's alpha reliability coefficients of ECSII'S subscales for Rural Sample

Subscale	Total[a]	Male[b]	Female[c]
T(AL)	.2884	.3473	.2242
T(AQ)	.4442	.4637	.4186
T(VL)	.5229	.5771	.4370
T(VQ)	.5718	.5615	.5893
Q(A)	.4015	.4009	.4005
Q(O)	.3597	.3593	.4931
Q(S)	.5009	.5416	.6502
Q(T)	.4653	.6084	.2115
Q(V)	.2235	.1772	.2789
Q(P)	.4011	.3893	.3994
Q(CEM)	.5010	.6214	.2865
Q(CES)	.6404	.6975	.5185
Q(CET)	.5959	.5839	.6071
Q(CH)	.4845	.5168	.4569
Q(CK)	.4362	.5108	.3544
Q(CKH)	.4482	.5347	.4358
Q(CP)	.3991	.4848	.1888
Q(CS)	.5437	.5692	.5311
Q(CT)	.5354	.5166	.5599
A	.5258	.4704	.5739
F	.7087	.7240	.6910
I	.4703	.4999	.4306
D	.3138	.3622	.2587
L	.5797	.6900	.3916
M	.3269	.3351	.2852
R	.5224	.5393	.5015
K	.4443	.3208	.4033

n^a = 171. n^b = 84. n^c = 87.

Table 9

Product-moment Correlation Coefficient Matrix

	T(AL)	T(AQ)	T(VL)	T(VQ)	Q(A)	Q(S)	Q(O)	Q(T)	Q(V)	Q(P)	(QCEM)	Q(CES	Q(CET)
T(AL)	-												
T(AQ)	40	-											
T(VL)	19	32	-										
T(VQ)	37	40	37	-									
Q(A)	25	32	35	31	-								
Q(S)	24	20	34	34	47	-							
Q(O)	20	22	28	29	50	48	-						
Q(T)	19	21	30	28	47	51	52	-					
Q(V)	32	30	13	30	26	29	25	24	-				
Q(P)	35	44	27	35	32	25	26	23	32	-			
Q(CEM)	35	37	31	30	31	27	30	32	26	42	-		
Q(CES)	34	39	38	32	36	36	34	34	32	33	43	-	
Q(CET)	30	24	33	35	37	43	36	39	20	19	34	36	-
Q(CH)	31	41	27	31	23	13	10	18	16	44	38	33	14
Q(CK)	35	28	24	23	26	22	29	23	29	30	36	34	23
Q(CKH)	37	40	29	40	33	30	30	26	31	51	35	35	31
Q(CP)	27	25	28	23	32	36	38	39	29	19	32	34	32
Q(CS)	24	33	30	38	46	46	44	44	19	29	32	29	38
Q(CT)	41	44	34	38	32	23	27	23	25	46	46	41	28
A	32	30	21	26	25	27	23	23	33	32	38	37	15
F	27	27	29	37	30	41	38	35	29	26	28	38	49
I	21	27	32	34	39	40	36	37	22	26	26	31	33
D	28	29	29	36	39	41	43	41	24	26	32	35	38
L	39	39	32	37	27	24	20	23	30	40	41	40	28
M	42	36	32	35	33	33	24	31	32	34	40	43	47
R	32	37	35	41	37	33	29	30	30	38	33	37	32
K	38	47	37	46	39	36	26	35	32	43	36	43	36

Table 9 - continued

	Q(CH)	Q(CK)	Q(CKH)	Q(CP)	Q(CS)	Q(CT)	A	F	I	D	L	M	R	K
T(AL)														
T(AQ)														
T(VL)														
T(VQ)														
Q(A)														
Q(S)														
Q(O)														
Q(T)														
Q(V)														
Q(P)														
Q(CEM)														
Q(CES)														
Q(CET)														
Q(CH)	-													
Q(CK)	37	-												
Q(CKH)	33	36	-											
Q(CP)	21	29	27	-										
Q(CS)	16	17	36	32	-									
Q(CT)	50	40	42	26	32	-								
A	39	40	34	26	21	43	-							
F	10	23	35	30	38	27	19	-						
I	18	20	24	32	39	24	11	23	-					
D	16	30	37	37	42	32	28	43	35	-				
L	40	40	26	26	26	43	35	28	23	30	-			
M	36	35	41	35	31	39	26	39	29	32	44	-		
R	32	34	44	28	34	38	32	33	31	40	41	42	-	
K	43	34	45	28	36	43	34	33	30	40	49	48	52	-

Note. All correlations were significant at p <.001.

[a] n = 811.

Results indicate low and moderate intercorrelations among the ECSII subscales. Moderate correlations seem to reflect expected relationships between related categories, e.g., Auditory with Savory (r=.47), Olfactory (r=.50), and Tactile (r=.47). Another group of subscales which demonstrate their relationship are Deductive with Appraisal (r=.49), Magnitude (r=.48), and Relationship (r=.52) subscales.

In general, correlation coefficients among the 27 subscales ranged from .11 to .52 . The highest correlation occurred between subscales Relationship (R) and Deductive K, (r=.52), and between subscales Tactile Q(T) and Olfactory Q(O), (r=.52). At the same time, the lowest correlation was between subscales Individuality (I) and Associates (A), (r=.11), which indicates a fairly weak relationship between (I) and (A). This is contradictory to what might be expected given Hill´s position that subscales (I) and (A) belong to the same scale II.

Both alpha reliability coefficients and intercorrelation coefficients among the 27 subscales demonstrated low to moderate values. These results are consistent with Hill´s "multidimensionality" theory. That is, low correlations mean independency among subscales, and moderate correlations indicate a degree of relationship among subscales, which, when factor analyzed, should lead to a grouping of subscales in more than one factor.

Validity

In the present study, factor analysis is considered a preliminary step toward construct validity to determine the nature of the factors involved in the ECSII.

The factors are hypothetical or explanatory constructs which are postulated in order to arrive at a reasonable explanation of the relationships between factors (or scales) and the 27 ECSII subscales.

Factor Structure of the ECSII Subscales

The program PEARSON CORR (SAS, 1985) was used to compute the relationships among the 27 subscales. The correlation matrix, with 1.00 as the diagonal elements (Table 9), was tested to determine if it was suitable for common-factor analysis. A measure of sampling adequacy (MSA) proposed by Kaiser and Rice (1974) was used. If MSA approaches unity, the correlation matrix becomes highly suitable for common-factor analysis. If MSA is <.05, the correlation matrix is unacceptable for factor analytic purposes. In this study, the all-average MSA for the correlation matrix was 0.95, which supports its use in further factor analyses (Table 10).

Next, the correlation coefficients were transformed to squared multiple correlations (SMC) to be used as estimates of communality for the principal factor analysis (Table 11). Then the correlation matrix was factor analyzed

Table 10

Kaiser's Measure of Sampling Adequacy (Over-all MSA = 0.95)

Subscale	MSA
T(AL)	0.96
T(AQ)	0.96
T(VL)	0.95
T(VQ)	0.96
Q(A)	0.96
Q(O)	0.93
Q(S)	0.95
Q(T)	0.95
Q(V)	0.94
Q(P)	0.93
Q(CEM)	0.96
Q(CES)	0.97
Q(CET)	0.94
Q(CH)	0.92
Q(CK)	0.95
Q(CKH)	0.96
Q(CP)	0.96
Q(CS)	0.95
Q(CT)	0.95
A	0.93
F	0.93
I	0.94
D	0.96
L	0.97
M	0.95
R	0.97
K	0.96

Table 11

Prior Communality Estimates: SMC

Subscale	SMC
T(AL)	0.34
T(AQ)	0.39
T(VL)	0.31
T(VQ)	0.39
Q(A)	0.42
Q(O)	0.45
Q(S)	0.46
Q(T)	0.43
Q(V)	0.27
Q(P)	0.44
Q(CEM)	0.39
Q(CES)	0.40
Q(CET)	0.42
Q(CH)	0.42
Q(CK)	0.34
Q(CKH)	0.42
Q(CP)	0.31
Q(CS)	0.41
Q(CT)	0.47
A	0.35
F	0.40
I	0.32
D	0.40
L	0.40
M	0.45
R	0.39
K	0.50

by the program FACTOR/PRIN (SAS, 1985).

The results of the initial factor matrix are provided in Table 12. Cureton and D´Agostino (1983) use the rule that "if as many as 10% to 20% of the loadings in a column are as high as + .20, with at least one or two as high as + .25, this column and all previous columns should usually be retained" (p. 162). In this study, the highest loading in every row is on factor I and the second highest loading is on factor II or factor III. All loadings On factor I are above .45; factor II has 17 subscales loadings above + .20; and factor III has 5 subscales loadings above + .20, and 1 at .28, therefore, using this criterion the three factors were retained, and were considered ready for rotation as they stand.

The examination of the eigenvalues, in order of magnitude, and their differences among factors, provides the second support for the salient factors. A scree test was used to determine the number of factors to be retained, and the results are presented in Figure 3, and Table 13.

A basis for deciding a number of factors to rotate can be found in the cumulative percentages of the common variance the factors account for. According to Guertin and Bailey (1970), "factors should rarely be cut-off until at least 95% of the complete principal axes variance is accounted for . . . A more commonly occurring lower limit for small R´s probably would be when 98% of the variance has been incorporated" (p. 117). In this study, the

Table 12

Initial Factor Pattern for each of the 27 Subscales of the Educational Cognitive Style Interest Inventory (Form J-O)

Subscale	Factor I	Factor II	Factor III
T(AL)	0.54	-0.20	-0.05
T(AQ)	0.58	-0.24	-0.09
T(VL)	0.52	0.05	-0.08
T(VQ)	0.59	-0.02	-0.22
Q(A)	0.59	0.25	0.10
Q(O)	0.55	0.39	0.22
Q(S)	0.58	0.39	0.05
Q(T)	0.55	0.38	0.16
Q(V)	0.47	-0.08	0.07
Q(P)	0.58	-0.27	0.02
Q(CEM)	0.59	-0.13	0.13
Q(CES)	0.62	-0.03	0.05
Q(CET)	0.56	0.27	-0.21
Q(CH)	0.50	-0.43	0.11
Q(CK)	0.52	-0.19	0.20
Q(CKH)	0.62	-0.14	-0.07
Q(CP)	0.51	0.17	0.15
Q(CS)	0.57	0.29	-0.03
Q(CT)	0.63	-0.29	0.08
A	0.50	-0.24	0.28
F	0.55	0.23	-0.18
I	0.49	0.24	-0.02
D	0.59	0.22	-0.00
L	0.60	-0.26	-0.06
M	0.63	-0.08	-0.18
R	0.62	-0.07	-0.11
K	0.68	-0.13	-0.16

Note. The final communality estimates was 11.024.

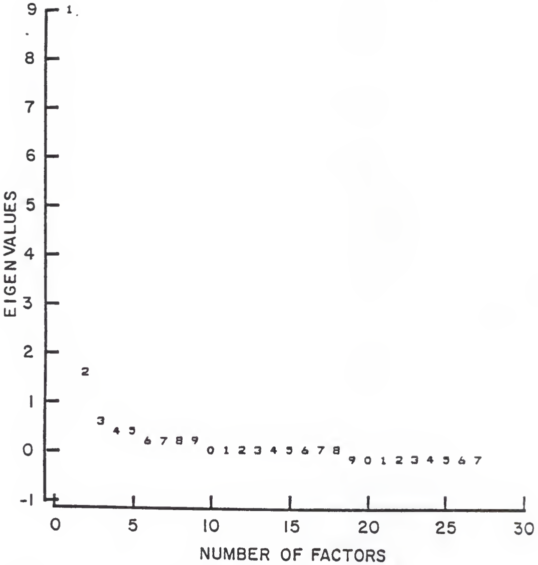


Figure 3. Initial Factor Method using the Scree Test.

Table 13

Distribution of Subscales Variance

Factor	Eigenvalue	Percentage of Total Variance	Percentage of Common Variance
I	8.93	33.07	81.03
II	1.57	5.81	14.24
III	0.52	1.92	4.71
Total	11.02	40.80	99.98

Note. Data came from the initial factor matrix.

cumulative value for the first three factors was equivalent to 99.98% of the common variance (Table 13). Thus the three factors were retained, and were ready for rotation.

A varimax pre-rotation was conducted and resulted in the emergence of three group factors, whose components (or subscales) appeared to share common variance. Next, an oblique rotation was performed; and the results demonstrated moderate interfactor correlations between factor I and factor II (*r* =.46), factor I and factor III (*r* =.54), and between factor II and factor III (*r* =.51). This could be interpreted in terms of Hill´s theory. In this case, factor I or scale I (symbols and their meanings) is related in some way to factor II or scale II (cultural determinants) and to factor III or scale III (modalities of inference). Therefore, the ECSII is comprised of three group factors, which suggest that ECS is a multidimensional, complex construct.

In order to provide evidence of the validity of the author´s concept of Educational Cognitive Style Interest Inventory (Form J-O), the factors extracted by an oblique rotation are provided in Table 14. A factor loading of +.30 was considered as salient or significant for further interpretation (Guertin & Bailey, 1970). Factor I has 13 salient subscales, factor II has 10 salient subscales, and factor III has 8 salient subscales with loadings greater than +.30. The data on Table 14 were reordered by the subscales for better interpretation (see Table 15). The

Table 14

Rotated Factor Pattern for the 27 subscales of the Educational Cognitive Style Interest Inventory (Form J-O)

Subscale	Factor I	Factor II	Factor III
T(AL)	0.41	-0.01	0.25
T(AQ)	0.44	-0.04	0.30
T(VL)	0.14	0.23	0.27
T(VQ)	0.16	0.10	0.46
Q(A)	0.12	0.55	0.06
Q(O)	0.03	0.74	-0.09
Q(S)	-0.04	0.65	0.12
Q(T)	0.01	0.69	-0.01
Q(V)	0.35	0.15	0.06
Q(P)	0.54	-0.01	0.16
Q(CEM)	0.49	0.18	0.03
Q(CES)	0.36	0.25	0.14
Q(CET)	-0.12	0.38	0.45
Q(CH)	0.71	-0.15	0.02
Q(CK)	0.56	0.12	-0.08
Q(CKH)	0.38	0.06	0.30
Q(CP)	0.18	0.46	-0.01
Q(CS)	-0.02	0.51	0.23
Q(CT)	0.63	0.01	0.10
A	0.65	0.12	-0.18
F	-0.07	0.35	0.40
I	-0.00	0.43	0.18
D	0.07	0.47	0.19
L	0.49	-0.05	0.28
M	0.25	0.08	0.43
R	0.28	0.12	0.35
K	0.34	0.05	0.43

Table 15

Rotated Subscales (reordered), Communalities, and Factor Loadings Greater Than ± .30

Subscale	Factor I	Factor II	Factor III	h^2
Q(CH)	71	-	-	45
A	65	-	-	39
Q(CT)	63	-	-	49
Q(CK)	56	-	-	35
Q(P)	54	-	-	41
Q(CEM)	49	-	-	39
L	49	-	-	43
T(AQ)	44	-	30	40
T(AL)	41	-	-	34
Q(CKH)	38	-	30	41
Q(CES)	36	-	-	40
Q(V)	35	-	-	23
Q(O)	-	74	-	51
Q(T)	-	69	-	48
Q(S)	-	65	-	49
Q(A)	-	55	-	43
Q(CS)	-	51	-	42
D	-	47	-	40
Q(CP)	-	46	-	31
I	-	43	-	30
T(VQ)	-	-	46	40
Q(CET)	-	38	45	43
M	-	-	43	44
K	34	-	43	51
F	-	35	40	39
R	-	-	35	40
T(VL)	-	-	-	28

Note: Decimal points, and factor loadings less than .30 are omitted, but they were included in the analysis.

subscales T(AQ), Q(CET), Q(CKH), K and (F) demonstrated that they are "factorially complex" due to their loadings on more than one factor.

All other subscales loaded on only one factor, which is an indication that they are relatively "pure" measures of their respective factors or scales; and are considered to be measuring something in common. Using the + .30 and above criterion, only the T(VL) subscale did not load on any of the three factors, although its highest loading was on factor III (loading = .27).

The plots of the rotated matrix are presented in Figures 4, 5, and 6, respectively. Variables that are highly and positively correlated should appear near each other and away from variables with which they do not correlate. For example, in Figure 4, the subscales Olfactory Q(O) and Tactile Q(T) are closely correlated (see reference axes factor II), and away from Qualitative Code Proxemics Q(P) and Qualitative Code Transactional Q(CT), (see reference axes factor I).

When analyzing the nature of the three factors (or scales) in Table 15, one can try to rationalize the particular grouping of subscales on each factor. For instance, 10 subscales load heavily on factor I [Q(CH), (A), Q(CT), Q(CK), Q(P), Q(CEM), (L), T(AL), Q(CES), and Q(V)] without considering the three subscales that load on more than one factor. These subscales were congruent with

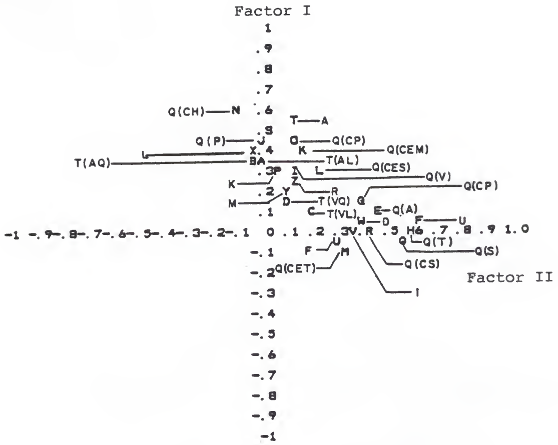


Figure 4. Plot of Reference Structure for Factor I and Factor II.

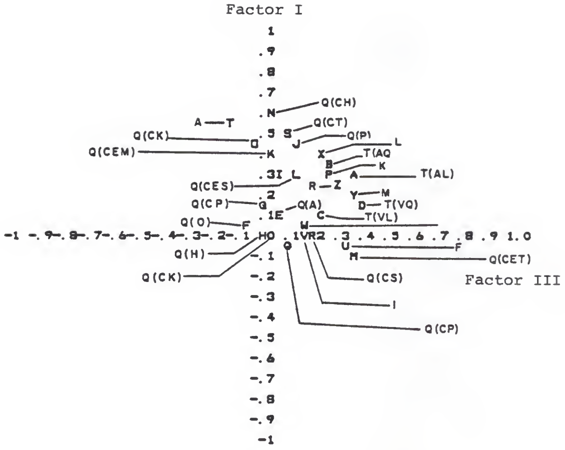


Figure 5. Plot of Reference Structure for Factor I and Factor III.

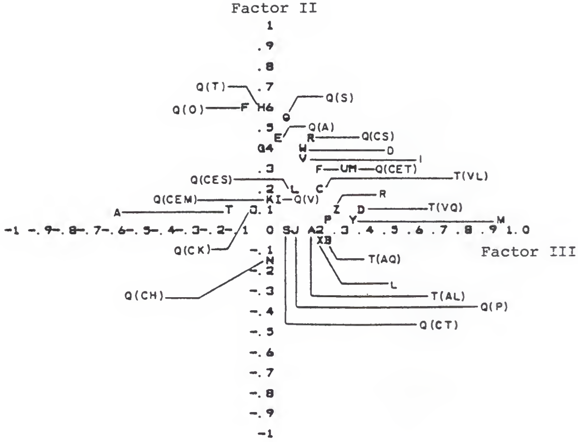


Figure 6. Plot of Reference Structure for Factor II and Factor III.

those of Hill´s scale I (symbols and their meanings), except for subscales (A) and (L).

A possible explanation for the nature of factor I is as follows: Associate subscale, A, is related to meanings influenced by others and is near to Q(CH), which represents preference to play a role to produce some particular effect on other persons. Although, theoretically, these two subscales should be located on two different factors (or scales), practically, one could find that if a person is playing a role to influence other´s behavior, that person might also present behaviors closely related to being an associate, or being a peer-related person. The relationship among A and Q(CT) is represented by the person´s preference to maintain a positive communicative interaction to influence other persons. Moreover, the preference to communicate by non-verbal communication Q(CK) is also related to Q(CH), to (A), and to the qualitative subscale visual Q(V).

In another group factor, qualitative subscales associated with sensory stimuli were closely related to each other in factor II [Q(O), Q(T), Q(S), Q(A)]; the same occurred for the cultural determinant subscales, such as individuality (I) and family or authority figure (F), although the latter also loaded on factor III. Once again, these two cultural determinants subscales were congruent with Hill´s scale II, cultural determinants. The subscales loading on factor II also seem to be related to the

individuality behavior since getting meaning through senses is unique to each person.

From the eight subscales loading on factor III, the subscales (R), (M), and (K) were congruent with Hill's conceptualization of scale III, modalities of inference. The subscales T(VQ), related to written numbers, and T(AQ), how one gets meaning through spoken numbers, also loaded on factor III. Although these subscales were located on Hill's scale I, a review of the items or statements from these subscales reveals that they are related to math problems and facts. Besides, these subscales share common variance with subscales related to how one infers when solving problems [(R), (M), and (K)], and with the subscale (F).

Group Differences

This section deals with the question addressed in Chapter 1: What are the relationships between Educational Cognitive Style subscales and students' sex, grade level, and school location?

A 3x2 factorial design was used to determine whether there were differences among grade levels and sex for junior high school students on each of the 27 ECSII subscales. The independent variables grade level, sex, and school location were also used in a 2x2x2 factorial design among 7th- and 8th-grade students of a urban-rural sample.

Results of these analyses are reported in Table 16 through 21. A Bonferroni test for comparisons was used whenever the _F_ value for the main effect (or simple main effect) of grade level was significant to determine specific levels of difference. In addition, interactions are presented graphically.

Sex

Means and standard deviations of males and females of urban and rural samples are presented in Table 16 and 18, respectively.

Urban sample. Within the main effect of sex (see Table 17), the analysis revealed significant differences for the subscales Theoretical Visual Linguistic ($p<.01$), Qualitative Olfactory ($p<.01$), Qualitative Code Empathic ($p<.01$), Qualitative Code Esthetic ($p<.01$), Qualitative Code Ethic ($p<.05$), Qualitative Code Transactional ($p<.01$), Qualitative Code Kinesics ($p<.05$), and Associates ($p<.01$).

A review of the mean scores of male and female students (see Table 16) indicates that females achieved significantly higher scores than males in all the subscales mentioned. Females, in general, perceived themselves to be better able to learn by reading words T(VL), than did males. In addition, females scored higher than males in their perceptions to be committed to a set of values or principles Q(CET), better able to empathize Q(CEM), to appreciate the beauty of an object or an idea Q(CES), to maintain positive

Table 16

Means of the ECSII's Subscales by Grade Level and Sex of Urban Sample

Subscale	Sex		Grade		
	Male[a]	Female[b]	7[c]	8[d]	9[e]
T(AL)	27.30	27.15	27.22	27.53	28.30
T(AQ)	25.98	26.19	25.74	26.75	26.56
T(VL)	26.02	27.58	26.58	27.39	26.89
T(VQ)	26.36	25.75	25.98	25.76	26.60
Q(A)	28.53	29.16	28.96	28.78	28.52
Q(S)	30.26	30.93	30.85	30.05	30.26
Q(O)	27.95	30.11	29.05	28.76	29.12
Q(T)	30.32	30.71	30.76	29.74	30.45
Q(V)	27.22	26.65	26.87	27.00	27.11
Q(P)	27.23	26.79	26.54	27.78	27.79
Q(CEM)	27.79	29.82	28.27	29.02	30.24
Q(CES)	26.70	29.39	27.80	28.09	28.67
Q(CET)	28.41	29.78	29.47	28.08	28.78
Q(CH)	27.17	27.34	26.37	28.76	28.64
Q(CK)	25.56	26.89	25.88	27.15	26.37
Q(CKH)	26.71	26.51	26.50	26.55	27.05
Q(CP)	27.14	27.85	27.66	27.26	27.17
Q(CS)	28.85	29.26	29.19	29.17	28.51
Q(CT)	26.49	27.63	26.56	27.76	27.94
A	26.20	28.17	26.65	27.50	28.52
F	27.91	27.64	27.70	27.46	28.31
I	28.70	27.89	28.93	27.74	26.78
D	27.00	26.39	26.73	26.21	27.00
L	29.62	29.49	28.93	30.52	30.63
M	28.28	27.99	28.16	28.53	27.66
R	26.46	27.05	26.77	27.33	26.20
K	27.19	27.87	27.39	27.96	27.60

$n^a = 326$
$n^b = 314$
$n^c = 398$
$n^d = 117$
$n^e = 125$

Table 17

F Ratios of the Main Effects of Grade Levels and Sex for each of the 27 Subscales of the Educational Cognitive Style Interest Inventory (Form J-O), for Urban Sample

Subscale	Sex[a]	Grade Level[b]	Interaction[c]
T(AL)	0.17	2.26	1.34
T(AQ)	0.15	2.20	0.87
T(VL)	6.87**	1.22	1.86
T(VQ)	0.06	0.69	2.41
Q(A)	0.68	0.29	0.45
Q(S)	2.97	1.02	0.66
Q(O)	14.51**	0.23	0.13
Q(T)	0.49	1.62	0.95
Q(V)	0.29	0.10	1.01
Q(P)	0.20	4.37*	3.52*
Q(CEM)	32.71**	9.82**	3.08*
Q(CES)	30.50**	1.83	0.18
Q(CET)	5.19*	2.75	0.22
Q(CH)	1.23	10.61**	0.84
Q(CK)	4.07*	3.14*	1.66
Q(CKH)	0.07	0.48	0.89
Q(CP)	3.42	0.55	0.11
Q(CS)	1.43	0.76	0.65
Q(CT)	8.23**	5.33**	0.51
A	22.02**	7.54**	0.54
F	2.45	5.14*	1.20
I	0.41	1.00	0.40
D	2.50	0.93	0.13
L	1.05	8.03**	0.59
M	0.71	0.66	0.48
R	1.65	2.12	0.03
K	0.46	3.20	0.87

[a] $n = 640$, df = 2, 634

[b] $n = 640$, df = 1, 634

[c] $n = 640$, df = 2, 634

* p = <.05
** p = <.01.

Table 18

Means of the ECSII's Subscales by Grade Level and Sex of Rural Sample

Subscale	Sex		Grade		
	Male[a]	Female[b]	6[c]	7[d]	8[e]
T(AL)	27.22	26.78	27.37	26.50	26.89
T(AQ)	26.55	25.34	25.76	26.03	26.18
T(VL)	26.89	27.81	26.96	27.82	27.57
T(VQ)	27.09	26.63	27.09	26.90	26.28
Q(A)	30.36	29.24	29.02	29.96	31.21
Q(S)	33.14	32.83	32.06	33.11	33.42
Q(O)	30.70	30.28	29.34	31.25	31.47
Q(T)	32.73	33.00	32.32	33.01	33.84
Q(V)	28.11	27.59	28.22	27.50	27.55
Q(P)	27.69	25.85	26.01	27.26	27.63
Q(CEM)	27.66	28.62	27.71	28.05	29.21
Q(CES)	26.84	28.79	28.16	27.61	27.44
Q(CET)	30.39	31.28	31.02	30.84	30.47
Q(CH)	26.00	25.40	25.09	25.82	26.78
Q(CK)	25.02	25.34	24.46	25.51	26.26
Q(CKH)	27.60	27.31	26.79	27.28	29.10
Q(CP)	27.39	28.82	27.02	29.03	29.21
Q(CS)	30.27	30.13	30.03	30.00	30.84
Q(CT)	25.80	26.19	25.48	25.88	27.28
A	26.50	27.54	26.44	27.53	27.57
I	28.47	28.62	28.16	28.17	29.21
F	31.58	32.25	31.49	33.00	31.36
D	27.60	28.08	26.88	28.01	28.28
L	29.01	28.87	27.98	29.76	29.84
M	29.01	27.67	28.40	28.23	28.31
R	26.78	25.11	25.75	25.78	26.52
K	26.91	26.47	26.59	26.46	27.21

$\underline{n}^a = 326$

$\underline{n}^b = 314$

$\underline{n}^c = 398$

$\underline{n}^d = 117$

$\underline{n}^e = 125$

interactions Q(CT), to communicate non-verbally Q(CK), and to rely more on friends (A). These results supported the conclusions of Gupta (1974) who found that there were sex differences present in cognitive styles.

Rural sample. Within the main effect of sex (Table 19), data analysis indicated significant differences in the subscales Theoretical Auditory Quantitative ($p<.05$), Qualitative Auditory ($p<.05$), Qualitative Proprioceptive ($p<.01$), Qualitative Code Esthetic ($p<.05$), Magnitude ($p<.05$), and Relationship ($p<.01$). A review of the mean scores of male and female students (see Table 18) revealed that males were significantly higher than females on all subscales mentioned, except for Qualitative Code Esthetic Q(CES).

In this case, males perceive meaning through the sense of hearing Q(A) and have a preference for spoken numbers T(AQ). They are also more able to use categorical reasoning (M) and display a preference for the use of the synthesizing technique in problem solving situations (R). The latter is associated with the males preference for combining a number of associated symbols into the performance of a task, Q(P). However, females have a significantly greater preference for appreciation of the beauty of an object or an idea Q(CES), than do males.

Table 19

F Ratios of the Main Effects of Grade Levels and Sex for each of the 27 Subscales of the Educational Cognitive Style Interest Inventory (Form J-O) for Rural Sample

Subscale	Sex[a]	Grade Level[b]	Interaction[c]
T(AL)	2.04	0.74	3.34*
T(AQ)	4.32*	0.26	2.00
T(VL)	0.28	0.55	1.72
T(VQ)	0.76	0.14	0.82
Q(A)	5.98*	4.18*	2.45
Q(S)	0.83	3.78*	1.62
Q(O)	1.37	4.41*	2.11
Q(T)	0.13	1.23	0.07
Q(V)	0.68	0.52	0.06
Q(P)	7.54**	2.11	0.75
Q(CEM)	1.09	1.05	0.27
Q(CES)	4.07*	0.30	0.12
Q(CET)	0.31	0.04	2.57
Q(CH)	0.30	4.67	4.67*
Q(CK)	0.03	2.22	1.18
Q(CKH)	1.75	3.73*	2.81
Q(CP)	2.61	4.81**	0.90
Q(CS)	0.27	0.49	1.23
Q(CT)	0.00	1.78	0.59
A	1.22	0.94	0.54
F	0.01	1.31	3.19*
I	0.00	0.74	0.33
D	0.08	3.75*	2.23
L	0.43	2.90	1.13
M	4.69*	0.10	0.25
R	7.50**	0.81	2.15
K	1.80	0.65	2.44

[a]n = 171, df = 1, 170

[b]n = 171, df = 2, 170

[c]n = 171, df = 2, 170

* p = <.05

** p = <.01

Grade Level

Means and standard deviations for 7th-, 8th-, and 9th-grade students, and 6th-, 7th-, and 8th-grade students of urban and rural samples are presented in Tables 16 and 18, respectively.

Urban sample. Within the main effect of grade level (see Table 17), there were significant differences in the subscales Qualitative Code Histrionic ($p<.01$), Qualitative Code Kinesics ($p<.05$), Qualitative Code Transactional ($p<.01$), Associates ($p<.01$), Family or authority figure ($p<.05$), and Appraisal ($p<.01$). These differences are an indication of variability in educational cognitive styles due to education and training as proposed by Hill (1981).

Table 16 reveals that there are no differences between 8th- and 9th-grade students although the latter perceived themselselves as learning better than 7th-graders via peer-relationship (A), as having the ability to fulfill role expectations Q(CH), maintaining a positive interaction with others Q(CT), and having a complex reasoning process (L).

Eighth graders had a greater preference to fulfill role expectations than 7th-grade students; the latter group showed a significant higher score on Family or authority figure than 8th-, and 9th-grade students.

Rural sample. Within the main effect of grade level (see Table 19), there were significant differences in the subscales Qualitative Auditory ($p<.05$), Qualitative Savory ($p<.05$), Qualitative Olfactory ($p<.05$), Qualitative Code

Kinesthetic ($p<.05$), Qualitative Code Proxemics ($p<.01$), and Difference ($p<.05$).

Seventh- and 8th-grade students achieved higher mean scores, on the above mentioned subscales than 6th-grade students. In this case, 7th- and 8th-grade students demonstrated their preferences to find meaning through the senses, they were more able to combine associated symbols into the performance of a task Q(P), to perform motor skills in an accepted form Q(CKH), to judge physical and social distance Q(CP), and to reason in terms of one-to-one contrasts (D). As with the higher grade levels of urban sample, a greater complexity of educatmonel cognitive style for 7th- and 8th-grade students over that of 6th-grade students was supported.

School Location

There were 640 urban students sampled as compared to 171 rural students. Because of this inordinately large difference in the numbers sampled, a subsample of 114 students from urban sample population was used to increase the power of the analysis. Means and standard deviations are presented in Table 20. A 2x2x2 factorial design was used, and the results of the effect of the third independent variable, school location, are shown in Table 21.

It appears that the location of school influences the preferences of students. There were significant effects on all the subscales except for T(VL), T(VQ), Q(V), Q(CES),

Table 20

Means of the ECSII s Subscales by School Location and Sex of Urban-Rural Sample

Subscale	School Location			
	Urban		Rural	
	Male[a]	Female[b]	Male[c]	Female[d]
T(AL)	28.02	30.20	27.72	25.65
T(AQ)	26.95	28.80	27.45	24.80
T(VL)	25.95	28.13	27.93	27.52
T(VQ)	25.32	26.96	27.36	25.95
Q(A)	26.75	27.15	31.70	29.32
Q(S)	27.19	28.62	34.45	33.21
Q(O)	24.73	25.56	32.45	30.63
Q(T)	28.04	27.22	33.62	33.09
Q(V)	26.65	28.37	27.81	27.23
Q(P)	28.73	29.77	28.77	26.13
Q(CEM)	29.40	30.84	28.20	28.86
Q(CES)	27.22	29.71	26.77	28.28
Q(CET)	26.75	27.90	30.54	30.82
Q(CH)	31.21	32.94	26.70	25.78
Q(CK)	28.01	28.30	26.09	25.58
Q(CKH)	27.72	28.09	28.93	27.21
Q(CP)	26.72	26.43	28.81	29.39
Q(CS)	26.34	27.18	30.86	29.86
Q(CT)	28.18	30.93	26.40	26.54
A	28.14	29.79	27.36	27.73
I	26.52	25.94	28.79	29.00
F	26.78	27.03	32.77	31.86
D	24.90	24.11	29.15	28.28
L	31.91	32.60	30.40	29.21
M	29.29	30.66	29.13	27.43
R	27.34	26.41	27.68	24.52
K	28.72	28.90	27.68	25.91

[a]n 61. [b]n 53. [c]n 44. [d]n 46.

Table 21

F Ratios of the Main Effect of School Location for each of the 27 subscales of the Educational Cognitive Style Interest Inventory (Form J-O) in a Subsample (n = 204) of 7th and 8th-graders

Subscale	Sex[a]	Grade Level[b]	Location[c]	Interaction[d] S x L
T(AL)	0.01	0.01	10.01**	9.08*
T(AQ)	0.29	1.02	5.59*	10.01**
T(VL)	1.52	0.05	1.01	3.92*
T(VQ)	0.01	0.00	0.60	4.79*
Q(A)	3.44	0.19	31.55**	4.63*
Q(S)	0.02	0.01	69.69**	4.19*
Q(O)	0.49	0.95	71.31**	3.59
Q(T)	0.08	0.11	71.37**	0.89
Q(V)	0.55	0.08	0.01	2.95
Q(P)	1.56	0.66	6.94**	8.05*
Q(CEM)	2.37	0.83	5.27*	0.50
Q(CES)	7.20**	0.60	1.64	0.39
Q(CET)	0.61	0.02	23.03**	0.77
Q(CH)	0.85	0.25	67.36**	2.74
Q(CK	0.21	0.10	8.25**	0.41
Q(CKH)	1.78	2.26	0.36	3.80
Q(CP)	0.08	0.83	12.95**	0.27
Q(CS)	0.01	5.95*	25.42**	2.42
Q(CT)	1.20	0.66	10.88**	2.18
A	2.08	0.04	3.99**	0.64
F	0.22	0.67	51.92**	0.82
I	0.19	0.95	15.37**	0.17
D	1.36	1.35	41.59**	0.01
L	0.12	0.44	12.22**	2.34
M	0.13	0.12	5.53*	5.18*
R	9.29**	0.81	0.80	2.78
K	1.64	0.13	5.83*	2.37

[a] $\underline{n}$ = 204, df = 1, 203

[b] $\underline{n}$ = 204, df = 1, 203

[c] $\underline{n}$ = 204, df = 1, 203

[d] $\underline{n}$ = 204, df = 1, 203

* p = <.05

** p = <.01

Q(CKH), and (R). However, significant interactions between sex and school location affected the results within the subscales T(AL), T(AQ), T(VL), T(VQ), Q(A), Q(S), Q(P), and (M). The significant differences found within the main effect of school location cannot be considered absolute because of the contaminating interaction between these two variables.

From these results, the urban sample was significantly higher than the rural sample in the sensitivity to the feelings of others Q(CEM), to fulfill role expectations Q(CH), to communicate non-verbally Q(CK), and to rely upon friends to arrive at a decision (A). Also, urban students are more able to use the appraisal reasoning pattern (L), when solving problems, and to use reasoning logical proofs, (K).

In contrast, the rural sample was significantly higher than the urban sample in perceiving themselves as learning better by using tactile Q(T), olfactory Q(O), and they were more able to know themselves Q(CS), more committed to a set of values Q(CET), to judge social distance Q(CP), to use one-to-one contrasts (D), and to rely upon the opinion of family members (F), or themselves (I), before reaching a decision.

Interactions

A significant interaction between grade levels and sex affected the results within the subscales Qualitative

Proprioceptive Q(P) and Qualitative Code Empathic Q(CEM) for the urban sample. A graphic representation of the interaction is shown in Figure 8, and F values are presented in Table 17. The types of interactions represented in Figure 7 are different. The subscale Q(P) interaction was disordinal while the subscale Q(CEM) interaction was ordinal. The Q(P) graph indicates that preferences of the 7th-, and 9th-grade students varied according to whether they were male or female. The Q(CEM) graph shows an increase for both males and females in 7th- through 9th grades. However, the range at 9th grade was higher than in 7th grade.

Significant interaction between grade levels and sex were found within the subscales Theoretical Auditory Linguistic T(AL), Qualitative Code Histrionic Q(CH), and Family or authority figure (F), for the rural sample. A graphic representation of the interaction is shown in Figure 8, and F values are presented in Table 19. The graphs in Figure 8 depict a disordinal and ordinal interaction for males and females. The mean scores for these subscales were dependent upon their grade level.

Significant interactions were found between sex and school location for the subscales Theoretical Auditory Linguistic T(AL), Qualitative Auditory Q(A), Qualitative Savory Q(S), and Magnitude (M). There was no interaction between grade level and sex, between grade level and location, or sex by grade level by location. All

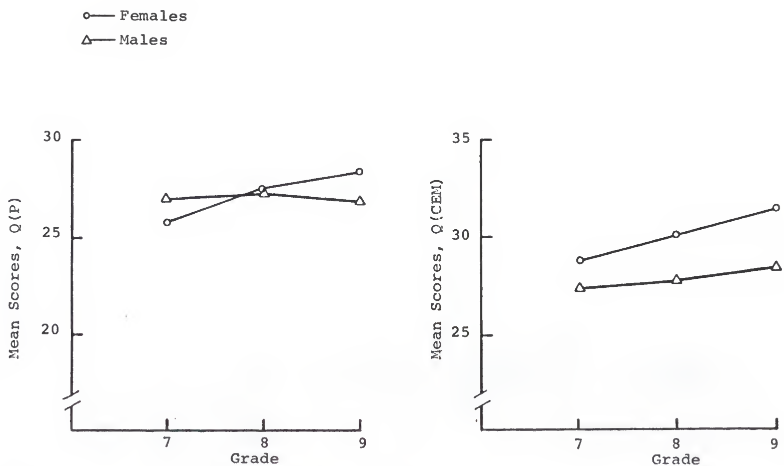


Figure 7. Interactions between Grade Level and Sex for the Subscales Qualitative Proprioceptive, and Qualitative Code Empathic, for the Urban Sample.

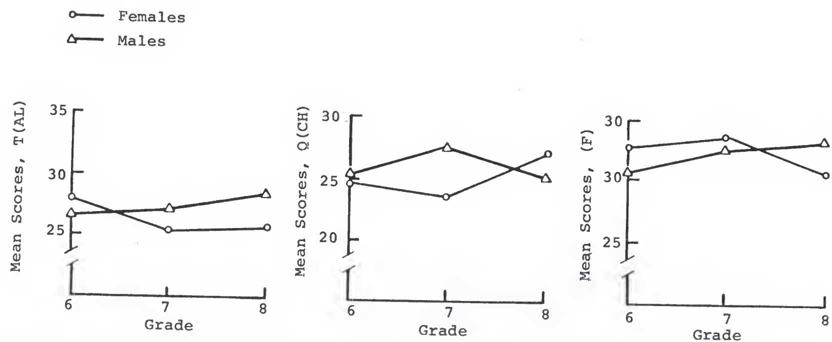


Figure 8. Interactions between Grade Levels and Sex for the Subscales Theoretical Auditory Linguistics, Qualitative Code Histrionic, and Family, for the Rural Sample.

interactions are shown in Figure 9, 10, and 11. The F values are presented in Table 21. The graphs for these subscales represent disordinal interactions with the same relative trends for males and females in urban and rural school locations. Females from urban schools attained higher scores on the subscales than males. However, in rural schools males achieved higher levels than females.

As a result of the significant interactions, the differences found for grade level, sex, and school location, for the subscales mentioned above, are subject to question, and have not been considered in the conclusions of the study.

Summary

The student sample population consisted of 811 students of 6th- through 9th-grade levels from central and north central Flcrida. The data of the inventories were used to derive means, standard deviations, and the correlation coefficient matrix for the ECSII subscales. From the descriptive statistics, means on the subscales for the total sample ranged from 26.05 to 30.88 and the standard deviations ranged from 4.62 to 6.42.

The Cronbach's alpha reliability coefficients were calculated to assess the internal consistency of the 27 subscales. For the entire inventory, alpha reliability coefficients range from .2579 on the subscale Qualitative

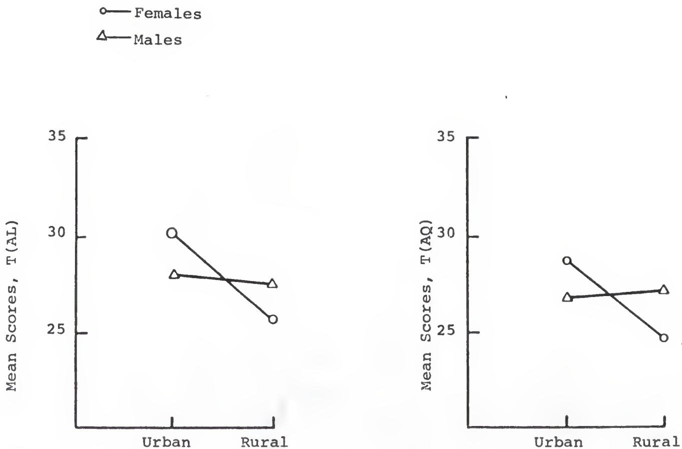


Figure 9. Interactions between School Location and Sex for the Subscales Theoretical Auditory Linguistics and Theoretical Auditory Quantitative for Urban and Rural Sample.

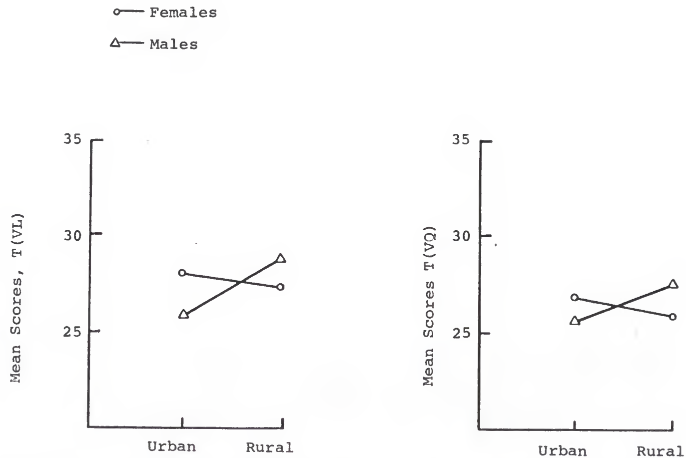


Figure 10. Interactions between School Location and Sex for the Subscales Theoretical Visual Linguistics and Theoretical Visual Quantitative for Urban and Rural Sample.

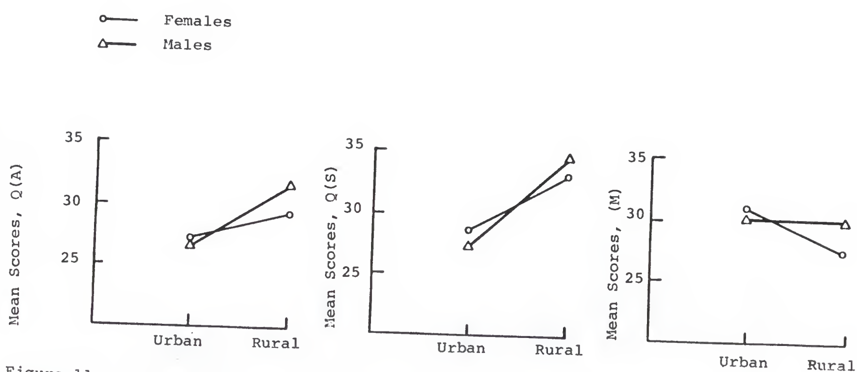


Figure 11. Interactions between School Location and Sex for the Subscales Qualitative Auditory, Qualitative Savory, and Magnitude for Urban and Rural Sample.

Code Proxemics Q(CP) to .7059 on the subscale Family or authority figure (F).

The program PEARSON CORR (SAS, 1985) was employed to determine the relationships among the ECSII subscales. Significant positive coefficients detected among all subscales ($p<.001$), ranged from .11 to .52. The highest correlation occurred between subscales Relationship (R) and Deductive (K), ($r=.52$), and between subscales Qualitative Tactile Q(T) and Qualitative Olfactory Q(O), ($r=.52$). The lowest correlation occurred between subscales Individuality (I) and Associates (A), ($r=.11$).

The correlation Matrix containing the value of 1.00 for the diagonal elements was transformed to squared multiple correlations, to be used as estimates of communality. Then the matrix was factor analyzed by the program FACTOR/PRIN (SAS, 1985).

There were three factors determined by the scree test of the principal factor analysis, which presented eigenvalues of 8.930, 1.574, and 0.519, and reflected 81.03%, 14.24%, and 4.71% of the common factor variance, respectively.

The rotated factor matrix revealed 21 subscales with salient loadings ($\pm.30$) on a single factor, 5 subscales loaded on 2 factors, and 1 subscale did not load on any factor. The total amount of variance accounted for by the common factors was 40.80%. In the obtained factor structure of the ECSII, 15 subscales were congruent with the structure proposed by Hill (1981).

A 3x2 factorial design was used in order to detect group differences among grade levels and sex in the junior high school sample (*n*=640). Within the main effect of sex, for the urban sample, there were significant differences (female>male) in the subscales T(VL), Q(O), Q(CEM), Q(CES), Q(CET), Q(CT), Q(CK), and (A). Within the main effect of sex for the rural sample (*n*=171), there were significant differences (male>female) in the subscales T(AQ), Q(A), Q(P), (M), and (R). In contrast, females demonstrated significantly higher scores than males in the subscale Qualitative Code Esthetic Q(CES). Within the main effect of grade level, for the urban sample, there were significant differences in the subscales Q(CH), Q(CK), Q(CT), (A), (F), and (L). Ninth graders demonstrated higher mean scores than 7th-grade students in the subscales (A), Q(CH), and (L). Eighth graders achieved higher than 7th-grade students in the subscale Q(CK), but this group showed higher scores than 8th-, and 9th-graders on the subscale (F). Within the main effect of grade level, for the rural sample, there were significant differences on the subscales Q(A), Q(S), Q(O), Q(CKH), Q(CP), and (D). Eighth-graders achieved higher scores than 6th- and 7th-grade students in all subscales mentioned above.

A 2x2x2 factorial design was used to include a third independent variable, school location. Results indicate that the urban sample was significantly higher than the

rural sample in the subscales Q(CEM), Q(CK), (L), (A). In contrast, the rural sample was significantly higher than the urban sample in the subscales Q(T), Q(O), Q(CS), Q(CET), Q(CP), (D), (F), and (I).

Significant interactions between grade levels and sex Q(P), Q(CEM), for the urban sample, and T(AL), Q(CH), and (F), for the rural sample, and between sex and school location T(AL), T(VQ), T(VL), T(VQ), Q(A), Q(S), and (D) were found among subscales. Disordinal and ordinal interactions for males and females revealed an increase or decrease in mean scores for these subscales. Variation in mean scores was dependent upon grade level and school location.

From the analysis and discussion of the results some conclusions and implications for further study have been drawn and will be presented in Chapter 5.

CHAPTER 5
CONCLUSIONS AND IMPLICATIONS FOR FURTHER STUDY

The degree cf confidence that users of the Educational Cognitive Style Interest Inventory (Form J-O) can place in interpreting results is directly related to both the reliability and validity of the instrument. Investigation of these psychometric properties was the primary concern of the present study. Another aspect was to determine if differences for the 27 subscales exist among 6th-through 9th-grade students from urban and rural samples. This chapter has been divided into three sections (a) conclusions of the study, (b) implications for further studies, and (c) summary.

Conclusions of the Study

The conclusions drawn from the present study have been based upon the six questions addressed in Chapter 1 and the analysis and discussion of results in Chapter 4. Additionally, this researcher suggests that the reader take into account the assumptions and limitations of the study outlined in Chapter 1. One of the main limitations to this

validation study is the use of a paper-and-pencil questionnaire, in which each statement is rated according to how one sees oneself, or to what one considers to be a value, interest, or way of behaving. This is a matter or how well one understands the statement and how one interprets it. Support for the use of this instrument may be found in an accummulation of evidence, such as the reliability coefficients for the 27 subscales, observers´ rating of student behaviors, personal interviews with students, parents, and teachers, reported relationship with other tests, case studies, and other available information. Thus, considering the limitations mentioned above, the contribution of this study should be viewed in conjunction with preliminary evidence for the validation of Mullally´s Educational Cognitive Style Interest Inventory (Form J-O).

The results of this study support the following conclusions:

1. Educational cognitive styles of junior high school students developed by Mullally can be measured by the ECSII (Form J-O).

2. Reliability coefficients for The 27 subscales of the ECSII (Form J-O), though low to moderate, were adequate for studying group differences. However, if the inventory is to be used for making decisions about individuals, some procedures for increasing its reliability need to be developed.

3. The correlations among the 27 subscales ranged from low to moderate ($p<.001$), which indicates that Educational Cognitive Style is a multidimensinal construct.

4. School-related characteristics, such as grade level and school location, combined with personal-related characteristics, such as sex, affect the reliability of the instrument, and contribute to the factor structure of the ECSII (Form J-O).

5. The construct validity for the ECSII (Form J-O) was examined by a factor analysis technique. The results were evaluated using two approaches: (a) interpretation of the common factor analysis, and (b) a comparison of the relationships between factors and subscales to the original conceptualizations of ECS as outlined by Hill (1981). From the initial factor matrix, three factors emerged which accounted for 99.98% of the common-factor variance and 40.80% of the total amount of variance. Follcwing rotation, the factor structure of the ECSII (Form J-O) obtained from the sample under consideration was compared to Hill´s conceptualization of educational cognitive style. Some of the subscales contributing to the factors were the same as those proposed by Hill (1981), contributing support of construct validity for the instrument as ccnceptualized by Hill. In this study, 56% of the ECSII subscales loaded on the factors where they had been originally placed. These were: T(AQ), T(AL), Q(P), Q(CH), Q(CT), Q(CK), Q(CEM), Q(CKH), Q(CES), Q(V) for Hill´s scale I; (I), (A) for

Hill´s scale II, and (M), (R), and (K) for Hill´s scale III. Some implications for further studies will be suggested to examine hypotheses for those subscales in this study which did not load according to Hill´s original schema.

6. A different factor structure emerged from this factor analysis of the ECSII (Form J-O). This structure differs from Hill´s mainly in the placement of cultural determinants, qualitative symbols related to sensory stimuli subscales, and theoretical visual quantitative subscale loading in the modalities of inference scale. In other words, the composition of the factors of Mullally´s ECSII appear to be related to three different scales, which this researcher labeled as "Associate Learning Mode" (factor I), "Individuality Learning Mode" (factor II), and "Family/Authority-related Learning Mode" (factor III). An implication for future research from this finding will be drawn.

7. Statistically significant group differences on some subscales were found in this study, which provide support for the research hypotheses which postulated these differences. Male and female preferences in certain ECSII subscales suggested that group differences may need to be considered in interpretation of educational cognitive styles. Grade level and school location also affected variability in mean scores in some ECSII subscales. Differences in subscales scores among grade levels and school location are supportive of Hill´s (1981) contention

that ECS is influenced by education and differs according to the context, e.g., life-spaces.

Implications for Further Study

Based on previous research on the ECSII, and the results of the present study, the researcher offers the following suggestions for further study. There is a consensus among writers (Cronbach & Meehl, 1967; Mehrens & Lehmann, 1968; Whitla, 1968) that any valid test should also demonstrate reliability. With an interest inventory, this is best demonstrated by an analysis of the statements or items constituting the subscales; if the items are measuring the same construct, then the product will be a homogeneous subscale. In the present study, results of reliability coefficients for the total sample (*N* =811) were low to moderate. Some of the factors which affect reliability are the length of the instrument, group variability, administration of the test, sample size, and content of the items. The first four factors seem to have been adequately addressed in this study, therefore, should not have adversely affected the reliability coefficients for the instrument. For example, the size of the sample was considered adequate for a factor analysis based on the rule of number of subjects equal to 10 times the number of the variables (Guertin & Bailey, 1970). In this study the 811 subjects used met this criterion.

However, the internal consistency of the subscales is directly related to homogeneity of the items; the low to moderate final reliability coefficients seem to reflect that the sets items do not measure the same thing. That is, if the eight items per subscale were homogeneous in the content, e.g., if they all measure the same thing, more reliable subscales would result. In particular, examination of the internal consistency coefficients in the ECSII showed low reliability for the subscales Qualitative Code Proxemics Q(CP), and Qualitative Visual Q(V). Examples of items corresponding to Q(CP) are as follows: "I know how far I can go without getting into trouble at school," "I do not speak to a teacher until spoken first," "I know when someone doesn´t want to listen to me," "I would rather ask favors of close friends rather than my teachers," and I would not introduce myself to a famous person." All of these items logically should be measuring Q(CP), which is related to the interpretation of the physical and social distance that the other person would permit between oneself and that other person. For the first item, it could be possible that the student´s interpretation of what constitute "trouble at school" could affect the responses. Those students which are more peer-related could answer the item asking for "favors of close friends rather than the teacher" differently than children who are more family or authority figure-oriented. The last item that refers to introducing "myself to a famous person" could produce high scores if

students are more individual-oriented. Moreover, the repeated use of the word "teacher" could produce a biased response because of the authority figure that teachers represent in a school environment. An example of a questionable item for Q(V) that could affect the reliability coefficient might be related to the item that reads: "I understand a teacher better if I can see him while he talks." The responses to this item could be affected if the student demonstrated a family-orientation. In this case, it is suggested that the content of the items be analyzed to determine how they are related to each other, and how they are related to the attribute they are supposed to measure. Ideally, items should be more highly related to those items with which they share a subscale than those on the other subscales (Nunally, 1978). Elimination of items not conforming to this pattern may help to increase the internal consistency of the subscales, thus gaining the advantages connected with a more reliable instrument.

Another possibility for further study might be derived from the results of the factor analysis of the ECSII. A "new" structure emerged for the ECSII, and the factors or scales were labeled according to the relationships found among the subscales grouped on the three factors. According to Hill (1981), man derives meaning as "an individual cast in a social role, a role which has expectations imposed upon it by societal norms and groups with which the individual interacts" (p. 439). It is in these social systems (groups,

family) that a person derives meanings from symbols, and makes his or her decisions from associate, individually, and family or authority figure.

In order to confirm the new structure proposed, a factor analysis should be done with data from another sample. If the factors emerge as proposed, this could constitute support of the construct validity for the ECSII and, in this case, should be regarded as an attempt to determine the nature of the factors, subject to later confirmation or disconfirmation (Kerlinger, 1973).

Moreover, it could be hypothesized that those students presenting a major orientation in the "Associate Learning Mode" subscales would learn better in a group interaction situation. Conversely, those with a major orientation in "Family/Authority Figure Learning Mode" would learn better with teachers, and those with preferred "Individual Learning Mode" would learn better when given independent assignments. It is suggested that observers´ ratings of the student´s performance be used to confirm the hypothesis.

A study regarding the stability of the ECSII may be relevant to construct validity. A longitudinal study is suggested using a sample of students from sixth through ninth grades to determine if changes occur between students as groups and individually. The hypothesis to be tested would be that changes will occur due to education and training, as proposed by Hill (1981). In this type of study it is recommended that researchers also take into account

other variables beside the ones used in this study. Examples are parents´ socioeconomic status, cultural values, religious affiliation, and language and cultural background of the students.

Summary

In summary, the following conclusions and implications may be drawn from the present study. The ECSII (Form J-O) was reported being reliable if used with groups, but the internal consistency of the instrument is questionable for individual diagnosis. However, these results should be viewed not as conclusive, but rather as exploratory in nature. This researcher has suggested some improvements and refinement of Mullally´s instrument.

It is the belief of this researcher that users of the ECSII (Form J-O) should take into consideration both the validation evidence provided by the test developer, and that reported in subsequent research. Many types of evidence relevant to the psychometric properties of the instrument should be examined, such as content validity, interitem correlations, intertest correlations, stability studies over time, and under experimental conditions. The integration of diverse data cannot be entirely quantitative, since usefulness and practicality, for example, are in the subjective domain. Any separate evidence for each of the inferences to be made regarding the Educational Cognitive

Style Interest Inventory (Form J-O) will contribute to its validation, and will enhance its potential for its use by teachers in a classroom situation.

APPENDIX A

EXAMPLE OF STUDENT PROFILE BASED ON THE EDUCATIONAL COGNITIVE STYLE INTEREST INVENTORY (FORM J-O)

U N I V E R S I T Y   O F   F L O R I D A

EDUCATIONAL COGNITIVE STYLE MAP

SS NO	NAME	CAMPUS	GRADE	INVENTORY DATE	INVENTORY FORM
000-00-0000		UNIVERSITY OF FLORIDA	SEVENTH	3/82	01

	NEGLI-GIBLE	MINOR	MAJOR	SYMBOL	WITHIN THE CONTEXT OF THE E. C. S. INVENTORY THIS INDIVIDUAL EVALUATED HIMSELF, OR HERSELF, TO BE CURRENTLY:
					PREFERENCES IN RECEIVING/TRANSMITTING INFORMATION
1	X			T(AL)	- UNCOMFORTABLE IN RECEIVING INFORMATION THRU SPOKEN WORDS
2		X		T(AQ)	= LESS COMFORTABLE WITH RECEIVING DATA THRU SPOKEN NUMBERS
3		X		T(VL)	= LESS COMFORTABLE WITH RECEIVING INFORMATION THRU WRITTEN WORDS
4		X		T(VQ)	= LESS COMFORTABLE WITH RECEIVING DATA THRU WRITTEN NUMBERS
5		X		Q(A)	= LESS INCLINED TO USE HIS/HER SENSE OF HEARING
6			X	Q(O)	* INCLINED TO USE HIS/HER SENSE OF SMELL
7			X	Q(S)	* INCLINED TO USE HIS/HER SENSE OF TASTE
8			X	Q(T)	* INCLINED TO USE HIS/HER SENSE OF TOUCH
9		X		Q(V)	= LESS INCLINED TO USE HIS/HER SENSE OF SIGHT
10			X	Q(P)	* INCLINED TO PERFORM FINE OR GROSS MUSCULATURE TASKS
11		X		Q(CEM)	= LESS INCLINED TO EMPATHIZE TO GAIN INFORMATION
12			X	Q(CES)	* INCLINED TO USE BEAUTY OR ORDER TO GAIN INFORMATION
13		X		Q(CET)	= LESS INCLINED TO BE COMMITTED WHEN GAINING INFORMATION
14		X		Q(CH)	= LESS INCLINED TO ASSESS ROLE PLAYING TO GAIN INFORMATION
15		X		Q(CK)	= LESS INCLINED TO USE BODY LANGUAGE TO GAIN INFORMATION
16		X		Q(CKH)	= LESS INCLINED TO USE PREFERRED FORMAT WHEN GAINING MEANING
17			X	Q(CP)	* INCLINED TO OBSERVE SOCIAL OR PHYSICAL DISTANCE TO GAIN INFORMATION
18		X		Q(CS)	= LESS DISPOSED TO UNDERSTANDING ONESELF
19		X		Q(CT)	= LESS INCLINED TO CONVINCE OTHERS WHEN GAINING INFORMATION
					PREFERENCES IN SETTING
20			X	I	* LIKELY TO MAKE HIS/HER OWN INTERPRETATION OF INFORMATION
21		X		A	= LESS LIKELY TO USE PEERS IN INTERPRETING INFORMATION
22		X		F	= LESS LIKELY TO USE AUTHORITY FIGURES IN INTERPRETING INFORMATION
					PREFERENCES IN REASONING
23		X		M	= LESS DISPOSED TO MAKE DECISIONS THRU ORGANIZING INFORMATION
24		X		D	= LESS DISPOSED TO MAKE DECISIONS THRU DIFFERENTIATING INFORMATION
25		X		R	= LESS DISPOSED TO MAKE DECISIONS THRU RELATING INFORMATION
26			X	L	* DISPOSED TO MAKE DECISIONS THRU M, D, AND R BEHAVIORS
27		X		(K)	= LESS DISPOSED TO MAKE DECISIONS DEDUCTIVELY

- = NEGLIGIBLE.   = = MINOR.   * = MAJOR.   O = QUESTION(S) OMITTED

```
        T(AL)-  Q(A)=  Q(P)*  Q(CEM)=            I*            M=
        T(AQ)=  Q(O)*         Q(CES)*            A=            D=
G =  {  T(VL)=  Q(S)*         Q(CET)=    }  X  { F=  }  X  {   R=   }
        T(VQ)=  Q(T)*         Q(CH)=                           L*
                Q(V)=         Q(CK)=                           (K)=
                              Q(CKH)=
                              Q(CP)*
                              Q(CS)=
                              Q(CT)=
```

(Courtesy of Dr. Lee J. Mullally, January 15, 1984)

APPENDIX B

EDUCATIONAL COGNITIVE STYLE
INTEREST INVENTORY (FORM J-O)

EDUCATIONAL COGNITIVE STYLE

INTEREST INVENTORY (FORM J-O)

Introduction

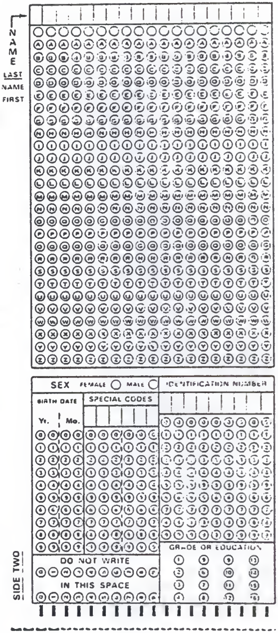
This interest inventory will be used to show how you seek meaning from the world around you. This is a self-report and not a test. There are no "good" nor "bad" styles. Different tasks require different styles. Educational Cognitive Style Mapping can show the ways in which you can be a successful student.

Directions

Using a #2 lead pencil,

1. Complete the basic information sections on the response form.

   a. On side two, print your name and complete the grid under your name by darkening the letters that spell your name. (Last name, first name).



   b. Darken the blank after "male" or "female".

   c. Darken the blanks under the "Grade or Education" section to show your grade.

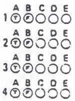
   d. Darken in the present year and month in the "Birth Date" section on the response form.

   e. Turn the response form over to SIDE ONE.

2. Open the inventory to the first statement,

   a. Read the statement
   b. Decide if it is like you "<u>Usually</u> <u>Sometimes</u>, or <u>Rarely</u>."
   c. Mark your answer on the response form:
      (A) Usually, (B) Sometimes, or
      (C) Rarely.
   d. You will <u>not</u> use answer spaces (D) or (E)

3. You will need to turn the response form over after answering statement 120. You may go directly to statement 121 and continue with the interest inventory.



4. Read the other statements and mark your answers on the form after reading each statement.

1. I can make more sense out of what a person means when he speaks to me rather than when he writes to me.

2. I find it easy to add spoken numbers in my head.

3. After I write a theme, I read it over to be certain it is correct.

4. I solve written mathematical problems quickly.

5. I can tell if a record is scratched by listening to it.

6. I can tell "what´s for dinner" by the smell.

7. I can tell whether milk is sour by tasting it.

8. I can feel the difference between blue jeans and corduroy.

9. I prefer to read books that have pictures or drawings.

10. I can run and catch a ball that has been hit or thrown.

11. My friends tell me that I am understanding.

12. I enjoy the beauty of people dancing.

13. The rules of our school should apply to everyone.

14. I can imitate someone else before a group.

15. I blush easily.

16. I can fix things with small parts without looking at my hands.

17. I would wait to be introduced to an adult rather than introduce myself.

18. I can tell when I will succeed most of the time.

19. Younger children find it easy to get along with me.

20. I learn a subject better when I can discuss it with my friends.

21. When choosing school classes, I would talk over the choices with my family.

22. I choose my own friends.

23. I understand an idea better if I compare it to other ideas.

24. I often have to make a decision before I know all the facts.

25. I work best when I am told what to do.

26. I would find it interesting to discover how people behave by understanding the things that make people tick.

27. I enjoy games or puzzles in which the answer is figured out from given information.

28. I do well on a test if it is about inofrmation I heard in class.

29. I remember figures that a newsman uses in his report.

30. My written explanations are better than my spoken ones.

31. I do best on written math tests.

32. The sound of a speaker's voice gives extra meaning to what he says.

33. I can tell when the basement is damp by the smell.

34. I use salt on my food until it tastes right.

35. I can get dressed in the dark.

36. I choose clothes for the way they look.

37. My partners tell me I am a good dancer.

38. I understand the feelings of others.

39. I would go out of my way to see beautiful scenery.

40. I do what I think is right.

41. I am a good actor.

42. I use facial expressions to show how I feel.

43. I am well coordinated.

44. I would rather ask favors of close friends than from adults.

45. I know how well I will do in a new situation.

46. In group discussions, I help the group reach decisions.

47. I enjoy activities more when my friends participate in them with me.

48. I like to do things with my family.

49. Religion is a personal thing.

50. To find out if I like someone, I compare them with differences in other people.

51. When I solve a problem, I try as many ways as I can.

52. I don´t feel sorry for people who break the rules.

53. I like to figure out how parts of a model fit together.

54. I like to reason by using a statement such as "all cats have tails; tigers are cats; tigers have tails."

55. I understand the daily news if I hear it on the radio.

56. Math tests that are read aloud are easy for me.

57. I do well in classes where I have to read the book.

58. If I got an allowance, I would keep a written record of how I spent it.

59. I can recognize who is on the phone by listening for a few moments.

60. I can tell the difference between several kinds of flowers by smelling them.

61. The taste of food is more important than how it looks.

62. I use my fingers to tell if the finish on wood is rough or smooth.

63. I enjoy art shows.

64. I can jump rope without watching my feet.

65. I understand how a person feels when being punished.

66. I enjoy concerts.

67. I would not accept money for a job I did not do.

68. I can make other people think I am happy and comfortable even though I am angry and uncomfortable.

69. I shrug my shoulders when saying "I don´t know."

70. I develop skills so that I can do well in sports.

71. I know when people ignore me.

72. I set goals I think I can reach.

73. I can help others settle an argument.

74. When shopping for clothes, I like to have a friend along to help me make choices.

75. I enjoy outdoor activities more if my family is with me.

76. I would rather do things my way even if they don´t agree with my family and friends.

77. When I pick out my clothes, I usually wear different colors.

78. I see why people don´t understand a problem until they know everything.

79. Life is simple if you go by the rules.

80. I tend to see all parts of the world as being related to each other.

81. When solving problems, I look for the reason my answer is correct.

82. I prefer to talk to my friends by telephone rather than writing notes to them.

83. When taking classes in math I find it easy when I´m told how to do the problems.

84. I do well on tests that measure reading understanding.

85. When I am in a group of people trying to solve a written problem involving numbers, I am among the first to reach the answer.

86. I recognize a song after hearing it once.

87. The smells in a room tell me whether it is pleasant or unpleasant.

88. Blindfolded, I can taste the difference between chicken and beef.

89. I prefer furniture that "feels" good when I run my hand over the material.

90. I understand a teacher better if I can see him when he talks.

91. I can write clearly when the teacher talks to the class.

92. I try not to say things which hurt the feelings of others.

93. I enjoy listening to good music for the quality of its sound.

94. I would not give an answer on a test even if my friends would be angry.

95. I am able to act out a part in a play.

96. I "talk with my hands."

97. I enjoy practicing dance steps until I can do them perfectly.

98. Unless spoken to first, I do not speak to the teacher.

99. I can tell whether or not I will be able to get my work done.

100. I can convince others to do the things that I would like them to do.

101. I like to share ideas with friends or classmates.

102. I talk with my family before doing anything that might affect them.

103. When given a problem to solve, I can come to the best answer by myself.

104. I compare my first test score to see if it is different from my next test score.

105. Information should be looked at in a number of ways before making a decision.

106. I like working in classrooms where there are rules.

107. When looking at something made by a person, I like to figure out why he made it.

108. I find the type of thinking used in math is the way I think.

109. I would rather hear directions than read them.

110. It is easy for me to remember numbers I hear.

111. I don´t have any trouble in using a map to get someplace.

112. If I were given someone´s address, I would write down the house number.

113. I am able to tell which groups of instruments are playing at various times while listening to a record.

114. I can tell I´ve passed a bakery by its smell.

115. I would like to return to a restaurant because the food tasted good.

116. I can tell by touch when a basketball needs air.

117. A story is easier to understand in a movie than in a book.

118. When I ride a bike, I look ahead and in other directions.

119. I am able to offer suggestions without hurting others.

120. I don´t get angry when someone is not paying attention to what I am saying.

121. I do not let TV shows bother me when doing my homework.

122. I can behave when I´m supposed to.

123. Walking with a bounce in your step gives the impression that you are happy.

124. To become a good typist, I would practice correct finger movements.

125. I know how far I can go without being punished.

126. I know what I can do.

127. If a new student came into class I would make him feel comfortable.

128. Before starting a project, I discuss it with my friends or classmates.

129. I find it important to check with my family before planning a party or activity.

130. I feel my personal goals are most important.

131. I try to get people to look at other points of view.

132. I take longer than others in making a decision because I want to know more about a problem than they do.

133. In general, I find it important to follow the rules.

134. I have no difficulty in understanding how to put puzzles together.

135. I find it easier to win an argument when I reason it out.

136. After I write a letter, I ask someone to read it to me so that I know that it sounds right.

137. I can remember a telephone number once I hear it.

138. I like to read papers rather than have them read to me.

139. I find it easy to understand written number problems.

140. I can tell the difference between two sounds that are almost alike.

141. The "smell" is an important part of the pleasure connected with a live Christmas tree.

142. In selecting a beverage, my choice is based on how it tastes.

143. I decide that my hair needs washing by the way it feels.

144. I would rather draw a picture about a person than write a story about the person.

145. I know when I bend my knees, I´ll stop bouncing on the trampoline.

146. When someone is afraid, I can understand how they feel.

147. I enjoy the beauty of the stars.

148. I believe that a promise should be kept.

149. I can act hurt in order to get my way.

150. When I shake hands with someone, the handshake tells me something about them.

151. When I play tennis or other sports, I take several practice swings before I start to play.

152. I feel uncomfortable when someone puts their hand on my shoulder.

153. I know how hard I will have to work to get something done.

154. Friends involve me in solving problems.

155. I make personal decisions after discussing them with my friends.

156. I understand events better after I have discussed them with my family.

157. I don´t need anyone to help me make up my mind.

158. Holidays are different from other days of the year.

159. A person can never know enough about life.

160. When shopping for clothes, if I find the article I had in mind at a fair price, I buy it without hunting for a better price.

161. I try to understand why people break rules.

162. There is a reason for everything that happens.

163. People say I talk better than I write.

164. I discuss the "sale" prices before I go shopping.

165. I would rather read directions than have someone read them to me.

166. When I go shopping, I try to figure out what the total bill will be by adding the prices in my head.

167. I can´t concentrate in a classroom if it´s noisy.

168. I can tell when a room is being painted by its smell.

169. I enjoy trying new foods in order to find new tastes that are pleasing to me.

170. I can tell the difference between a nickel and a dime in my pocket without looking at it.

171. When I change the station on the radio, I pay close attention to the numbers on the dial.

172. I can pitch horseshoes or lawn darts quite well.

173. I don´t get angry when someone is not paying attention to what I am saying.

174. Poetry is beautiful because of its meaning as well as its words and form.

175. I will work just as hard when the teacher is away.

176. I can shout and act tough in order to frighten others when I am frightened myself.

177. I know a person´s mood by the way he sits or poses.

178. Learning to swing a bat or golf club the right way is important.

179. If I bump against another person in a store, I say I´m sorry.

180. I can force myself to finish boring activities.

181. At parties, I am able to stop arguments involving others by speaking to those who are involved.

182. I value my friends´ opinions.

183. I talk with my family before making important decisions.

184. My "best" decisions are made alone.

185. I choose music to fit my mood.

186. The more I know about a problem, the more I want to know about it.

187. I don´t find any reason to change my mind on a subject once I know the rule which applies.

188. There´s always a reason for a person´s behavior.

189. I can reason out a science experiment.

190. In a classroom I like to sit and listen to the information being given.

191. If I were buying a 10-speed bike, I would discuss the measurements of the bike with the salesperson.

192. I understand more easily by reading than by hearing.

193. If I were buying a 10-speed bike, I would ask the salesperson to provide written information.

194. I tune the radio by sound, not by looking at the dial.

195. When there are gas fumes in the car or the house, I smell them.

196. I look forward to Thanksgiving because I enjoy tasting the many different foods.

197. I prefer to write with a pen that "feels" good to my fingers.

198. I know someone better after seeing pictures of him rather than reading about him.

199. I am considered to be a "good" athlete.

200. I laugh with the person who laughs when he stubs his toe because I know it hurts.

201. Something should be nice looking as well as useful.

202. I would not cheat on a test even when the teacher is out of the class.

203. I can act interested even though I´m bored.

204. It is important that I look at someone when I talk to them.

205. I practice handwriting skills until I write clearly.

206. I pat strangers on the back if I have a reason to congratulate them.

207. I know what makes me nervous.

208. I can get others to follow directions which have been given.

209. I would join a club because my friends belong to it.

210. I make it a point not to let my plans interfere with my family´s plans.

211. When given a job to do, I like to work on it myself.

212. When I am learning about a different country in school, I look to see how it is different from my country.

213. There are many ways to solve a problem.

214. In evaluating the performance of others, I find it important to see if they followed directions.

215. I have to see more than one example to understand a problem.

216. I like to use reasons when solving a problem in math or science.

APPENDIX C

SOURCE OF INFORMATION ABOUT RELIABILITY AND VALIDITY COEFFICIENTS

OAKLAND COMMUNITY COLLEGE

George A. Bee
Administrative Center
Bloomfield Hills, Michigan

March 12, 1975

I trust that in your conversations with Mr. Barney Herron, you understand that educational cognitive style is highly dependent upon what James Jenkins of the University of Minnesota, a theorist on the topic of memory, calls "contextualism." The basic notion underlying the use of a cognitive style test and inventory battery is to produce a mathematical mapping which can be used by a trained mapper as aids to his empirical mappings of cognitive style elements. An analogy which might serve to clarify the issue would be that of how the medical doctor takes into account such mathematical mappings: body temperature, blood pressure, blood counts, counts of biochemical elements found in specimens of body fluids, and intensity counts associated with x-ray interpretations. In the process of questioning the patient to gain "empirical data" to diagnose the condition of the patient. Essentially, the medical doctor holds his empirical mapping process in a higher order of priority, or, if you will, "weight," than the mathematical mappings, in the process of diagnosing an individual´s condition of health. Contextualism enters into the doctor´s diagnosis in the form of a series of norms and situations with which the physician is trained to become familiar. For example, a physician may diagnose a 55-year-old man to be in "good health" in comparison with norms for 55-year-old persons in th context of pursuits usually included in the life space of a 55-year-old individual. If the person being examined were to indicate to the physician that he was planning to engage in physical activities (e.g., skiing, swimming) at a level of competition usually found associated with 19-22-year-old performers, the medical doctor might well revise his diagnosis of "good health" in consideration of that text.

Regardless of the matters noted above, I can provide you with validity and reliability indices that have been found, not only in some of our work here at the College, but in those doctoral dissertations (of the 84 that have been completed in this arena) dealing with community college samples. Under these circumstances, validity coefficients associated with the elements of T(VL), T(VQ), T(AL), and T(AQ) are as shown below:

T(VL)	Females	= .80	T(Al)	Females	= .75
	Males	= .72		Males	= .70
T(VQ)	Females	= .72	T(AQ)	Females	= .66
	Males	= .73		Males	= .61

Reliability coefficients are derived by means of the Kuder Richardson formula, based upon the concept of domain sampling. The coefficients for T(VL), T(VQ), T(AL), and T(AQ) are as shown below:

T(VL)	Females	= .93	T(AL)	Females	= .89
	Males	= .92		Males	= .89
T(VQ)	Females	= .92	T(AQ)	Females	= .89
	Males	= .93		Males	= .82

The validity and reliability coefficients associated with these elements of cognitive style mapping have been derived from sub-tests of the Differential Aptitude Tests (4th Ed. - Forms L and M - The Psychological Corp. - 1966), the Nelson-Denny Reading Test, the Carlsen-Brown Listening Test, and the quantitative section of the "Wechsler." Point biserial correlation coefficients for the qualitative symbolic elements, the cultural determinant elements of individuality, associates, and family; the modalities of inference elements of magnitude, difference, relationship, and appraisal show the range of values in biserial correlation coefficients indicated below:

low r = .54 to r = .93

The average biserial coefficient value for all these elements is:

r = .783

The reliability coefficient for the inventories that provide results for the mapping of these elements of style is a Kuder Richardson: r = .81. In regard to the topic of predictability, this matter depends greatly upon the ability of the diagnostician to empirically map the style of the individual under consideration in the context, or intended context, of the instructional setting.

I have asked my secretary to include a somewhat antiquated list of doctoral dissertations that have been completed in the Educational Sciences. Although I have copies of all dissertations that have been completed in the Educational Sciences, many of them are on loan to persons

currently engaged in doctoral dissertation work. Under these circumstances, I would be hArd-pressed to make these materials available to you. If I can resolve any of your difficulties by telephone, I would be most happy to oblige.

Thank you for your interest in these matters, and also for your understanding of the inordinate delay in my response to your letter.

Sincerely,

(original signed by Joseph E. Hill)

Joseph E. Hill
President

JEH/sp

OAKLAND COMMUNITY COLLEGE
George A. Bee
Administrative Center
Bloomfield Hills, Michigan

October 21, 1975

Mr. Bill Breese
1741 Francis Street, Room 14
Jacksonville, Florida 32209

Dear Mr. Breese:

Reliability coefficients derived by means of the Kuder-Richardson formula, based upon the concept of domain sampling, provide the best measurement of intercorrelation among elements and coefficients of stability. The Kuder-Richardson formula is used because it provides an excellent measurement of internal consistency.

Validity and reliability indices that have been found in some of our work here at the College and in doctoral dissertations (or the almost 100 that have been completed) dealing with community college samples, show the following validity coefficients associated with the elements of T(VL), T(VQ), T(AL), T(AQ):

T(VL)	Females = .80	T(AL)	Females = .75
	Males = .72		Males = .70
T(VQ)	Females = .72	T(AQ)	Females = .66
	Males = .73		Males = .61

The reliability coefficients for T(VL), T(VQ), T(AL), and T(AQ) are as shown:

T(VL)	Females = .93	T(AL)	Females = .89
	Males = .92		Males = .87
T(VQ)	Females = .92	T(AQ)	Females = .85
	Males = .93		Males = .82

The validity and reliability coefficients associated with these elements of cognitive style mapping have been derived from sub-sets of the Differential Aptitude Tests (4th Ed. - Forms L and M - The Psychological Corp. - 1966), the Nelson-Denny Reading Test, the Carlsen-Brown Listening Test, and the quantitative section of the "wechsler." Point bi-serial correlation coefficients for the qualitative symbolic elements, the cultural determinant elements of individuality, associates, and family; the modalities of

inference elements of magnitude, difference, relationship, and appraisal show the range of values of bi-serial correlation coefficients indicated below:

low $r_{bis} = .54$, to $r_{bis} = .93$

The average bi-serial coefficient value for all these elements is:

$$r_{bis} = .783$$

The reliability for the inventories that provide results for the mapping of these elements of style is a Kuder-Richardson: $r = .81$. In regard to the topic of predictability, this matter depends greatly upon the ability of the diagnostician to empirically map the style of the individual under consideration in the context, or intended context, of the instructional setting.

Utilization of a five-point response scale would, of course, be more desirable than the assignment of 1, 3, and 5 for answers of Rarely, Sometimes, Usually employed by our Diagnostic Center. An interval five-point scale, originally instituted by Dr. Hill, was, for practical considerations, changed by members of our Diagnostic Testing Center, who felt that the three categories (Usually, Sometimes, Rarely) would simplify the response for students. Dr. Hill suggests that having students place their answers on a zero through ten scale with ten being at the upper limit of a normal distribution curve and zero at the lower limit would even further enhance the accuracy of the results.

I am enclosing an updated bibliography of dissertations completed in the Educational Sciences. Several of the more recent dissertations are concerned with the fourth set of cognitive style-memory.

Sincerely yours,

(originally signed by Betty D. Setz)

Betty D. Setz, Director
Community Relations/
Research Administration

lt

enc.

List of References

Allport, G.W. (1937). Personality: A psychological interpretation. New York: Holt, Rinehart, and Winston.

Bloom, B.S. (1974). Time and learning. American Psychologist, 29, 682-688.

Bruner, J.S. (1966). Toward a theory of instruction. New York: W.W. Norton.

Bruner, J.S., Goodnow, J., & Austin, G. (1956). A study of thinking. New York: Wiley and Sons.

Compton, C.S. (1975). Comparative achievement of eighth graders with and without a multimedia Cognitive Style Mapping approach to instruction (Doctoral dissertation, University of Florida, 1975). Dissertation Abstracts International, 35, 7645A.

Coop, R.H., & Sigel, I.E. (1971). Cognitive style: Implications for learning and instruction. Psychology in Schools, 8, 152-161.

Cronbach, L.J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 294-334.

Cronbach, L.J. (1960). Validity. In C.W. Harris (Ed.), Encyclopedia of educational research. New York: Macmillan.

Cronbach, L.J., & Meehl, P.E. (1967). Construct validity in psychological tests. In W.A. Mehrens & R.L. Ebel, Principles of educational and psychological measurement. Chicago: Rand McNally.

Crowe, K.P. (1975). A comparative analysis of selected vocational and educational programs in terms of Educational Cognitive Style, to determine if sex bias exists (Doctoral dissertation, Wayne State University, 1974). Dissertation Abstracts International, 35, 7645A. (University Microfilms No. 75-13, 307)

Culley, K.E., Jr. (1978). Educational cognitive styles: Comparisons based on aptitude and achievement and prediction of some elements (Doctoral dissertation, Boston College, 1978). Dissertations Abstracts International, 39, 1286A.

Cureton, E.E., & D'Agostino, R.B. (1983). Factor analysis: An applied approach. Hillsdale, NJ: Lawrence Erlbaum Associates.

Dewey, J. (1938). Logic: The theory of inquiry. New York: Holt, Rinehart, and Winston.

Doney, D.L. (1980). A correlational study of Jungian Typology, as measured by the Myers-Briggs Type Indicator, and Educational Cognitive Style, as measured by the Oakland Community College Cognitive Style Map interest inventory (Doctoral dissertation, University of Florida, 1980). Dissertation Abstracts International, 41, 3856A.

Ebel, R.L. (1961). Must all tests be valid? American Psychologist, 16, 640-647.

Flanagan, J.C. (1939). General considerations in the selection of test items and a short method of estimating the Product-moment coefficient from the data at the tails of the distribution. Journal of Educational Psychology, 30, 674-680.

French, J.W., and Michael, W.B. (1966). Standards for educational and psychological tests and manuals. Washington, D.C.: American Psychological Association.

Gardner, R.W. (1953). Cognitive styles in categorizing behavior. Journal of Personality, 22, 214-233.

Garrett, H.E. (1958). Statistics in psychology and education (5th ed.). New York: Longmans, Green.

Goldstein, K.N., & Blackman, S. (1978). Cognitive styles. New York: Wiley and Sons.

Granger, R.H., Jr. (1979). A study of the relationship between Educational Cognitive Style and achievement in a discovery-approach junior high school curriculum (Doctoral dissertation, Kent State University, 1978). Dissertation Abstracts International, 39, 7133A.

Guertin, W.H., & Bailey, J.P., Jr. (1970). Introduction to modern factor analysis. Ann Arbor, MI: Edwards Brothers.

Guilford, J.P. (1959). Three faces of intellect. American Psychologist, 14, 469-479.

Guilford, J.P. (1967). The nature of human intelligence. New York: McGraw-Hill.

Gupta, G. (1974). Articulateness of the field and cognitive styles. Journal of General Psychology, 91, 3-8.

Harman, H.H. (1976). Modern factor analysis (Rev. ed.). Chicago: University of Chicago Press.

Hayakawa, S.T. (1964). Language in thought and action. New York: Harcourt, Brace and World.

Hill, J.E. (n.d.). Educational cognitive style interest inventory, Adult form. Oakland Community College, Bloomington Hills, MI.

Hill, J.E. (1981). The educational sciences: A conceptual framework. West Bloomington, MI: Educational Sciences Foundation.

Hill, J.E., & Kerber, A. (1967). Models, methods and analytical procedures in education research. Detroit: Wayne State University Press.

Hill, J.E., & Nunney, D.N. (1972). Personalized educational programs. Audiovisual Instruction, 17(2), 10-15.

Kagan, J., Moss, H.A., & Sigel, I.E. (1963). The psychological significance of styles of conceptualization. In J.F. Wright & J. Kagan (Eds.), Basic cognitive processes in children. Monographs of the Society for Research in Child Development, 28(2), 73-112.

Kaiser, H.F., & Rice, J. (1974). Little jiffy, Mark IV. Educational and Psychological Measurement, 34, 111-117.

Kelley, E.C. (1947). Education for what is real. New York: Harper.

Kerlinger, F.M. (1973). Foundations of behavioral research (2nd ed.). New York: Holt, Rinehart, and Winston.

Kimura, D. (1973). The asymmetry of the human brain. Scientific American, 61(3), 70-78.

Korzybski, A. (1958). Science and sanity: An introduction to non-Aristotelian systems and general semantics (4th ed.). Lakeville, CT: The International Non-Aristotelian Library.

Krejcie, R.V., & Morgan, D.W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30, 607-610.

Langer, S.K. (1942). Philosophy in a new key. Cambridge: Harvard University Press.

Lipson, P.E. (1975). Influence of Educational Cognitive Style and teaching style on grading practices in a junior high school (Doctoral dissertation, Wayne State University, 1974). Dissertation Abstracts International, 35, 7617A. (University Microfilms No. 75-13, 356)

Manilla, S.J. (1972). History of Oakland Community College with emphasis on multi-campus administration, systems approach to instruction, and the educational sciences (Doctoral dissertation, Wayne State University, 1971). Dissertation Abstracts International, 32, 6157A.

Mehrens, W.A., & Lehmann, I.J. (1980). Standardized tests in education (3rd ed.). New York: Holt, Rinehart, and Winston.

Mehrens, W.A., & Lehmann, I.J. (1984). Measurement and evaluation in education and psychology (3rd ed.). New York: Holt, Rinehart, and Winston.

Merton, R.H. (1968). Social theory and social structure (Rev. ed.). New York: The Free Press.

Messick, S. (1970). The criterion problem in the evaluation of instruction: Assessing possible, not just intended, outcomes. In M.C. Wittrack & D.E. Wiley (Eds.), The evaluation of instruction: Issues and problems. New York: Holt, Rinehart, and Winston.

Messick, S. (1976). Individuality in learning: Implications of cognitive styles and creativity for human development. San Francisco: Jossey-Bass.

Mullally, L.J. (1980). Educational cognitive style interest inventory, (Form J-O). University of Florida, Gainesville.

Nicewander, W.A., & Price, J.M. (1978). Dependent variable, reliability and the power of significance tests. Psychological Bulletin, 85, 405-409.

Nunnally, J.C. (1978). Psychology theory. New York: McGraw-Hill.

Nunney, D.N. (Ed.). (1978). Educational sciences dissertation abstracts. Bloomfield Hills, MI: American Educational Sciences Association.

Piaget, J. (1952). The origins of intelligence in children. New York: International University Press.

Phenix, P.H. (1964). Realms of meaning. New York: McGraw-Hill.

Robbins, H.A. (1977). A comparison study of cognitive styles across educational levels, race and sex (Doctoral dissertation, East Texas State University, 1976). Dissertation Abstracts International, 37, 2752A. (University Microfilms No. 76-24, 539)

Rundio, P.A. (1974). An exploratory study of educational cognitive style as a means of obtaining clues for personalizing the instruction of ninth grade students in biology (Doctoral dissertation, Wayne State University, 1973). Dissertation Abstracts International, 34, 6955A.

SAS Institute, Inc. (1958). SAS user´s guide statistics (5th ed.). Cary, NC: SAS Institute.

Sherif, M. (1964). The psychology of social norms. New York: Octagon.

Sheriff, D.E. (1978). A factor analytic study of Hill´s cognitive style inventory (Doctoral dissertation, Texas A&M University, 1977). Dissertation Abstracts International, 38, 196A. (University Microfilm No. 77;-32, 201)

Spearman, K. (1904). General intelligence, objectively determined and measured. American Journal of Psychology, 15, 201-293.

Thurstone, L.L. (1948). Psychological implications of factor analysis. American Psychologist, 3, 402-408.

Tyler, L.E., & Walsh, W.B. (1979). Tests and measurements (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Wertheimer, M. (Ed.). (1959). Productive thinking (Enlarged ed.). New York: Harper & Row.

Whitla, D.K. (1968). Handbook of measurement and assessment in behavioral sciences. Reading, MA: Addison-Wesley.

Witkin, H.A., Dyk, R.B., Faterson, D.H., Goodenough, D.R., & Kays, S.A. (1962). Psychological differentation. New York: Wiley and Sons.

Wittgenstein, L. von. (1953). Philosophical investigations. New York: Macmillan.

BIOGRAPHICAL SKETCH

Elizabeth Ruiloba was born on January 25, 1949, in Panama, Republic of Panama, and graduated from Fermin Naudeau High School in Panama, in 1967. She graduated from the University of Panama in 1971 with a Bachelor of Science degree in chemistry. She received a scholarship from the Research Corporation, New York, to study in the Nutrition Institute of Central America and Panama (INCAP)/University of San Carlos, Guatemala, C. A., in which she got her master´s degree in food science and animal nutrition in 1974. She returned to Panama and worked fcr five years as Animal Nutrition researcher at the Experimental Center of the Panamanian Agricultural Research Institute (IDIAP), Gualaca, Province of Chiriqui. From 1978 to 1980 she was the chairman of the publications department of IDIAP. She received a scholarship from IDIAP/USAID to study at the University of Florida, and in 1981, enrolled in the program of educational media and instructional design. She will receive her Doctor of Philosophy degree in instruction and curriculum in 1986. She is presently working in the Communication and Teaching department of IDIAP, Republic of Panama.

She was married in 1971 to Manuel H. Ruiloba and has two children, Humberto and Elaine. She is a member of Phi Delta Kappa and the Association for Supervision and Curriculum Development.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Lee J. Mullally

Lee J. Mullally,
Chairperson
Associate Professor of
Instruction and Curriculum

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Forrest Parkay

Forrest Parkay,
Associate Professor of
Educational Leadership

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Jeff Hurt,
Assistant Professor of
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This dissertation was submitted to the Graduate Faculty of the College of Education and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

May 1986

David C. Smith

Dean, College of Education

Dean, Graduate School